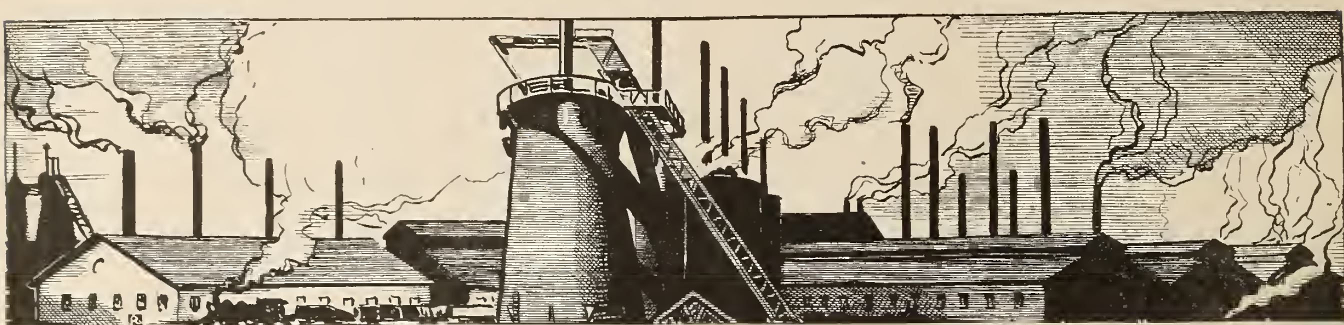
CANADIAN CHEMICAL JOURNAL

A Canadian Journal devoted to Metallurgy Electro-Chemistry and Industrial Chemistry.

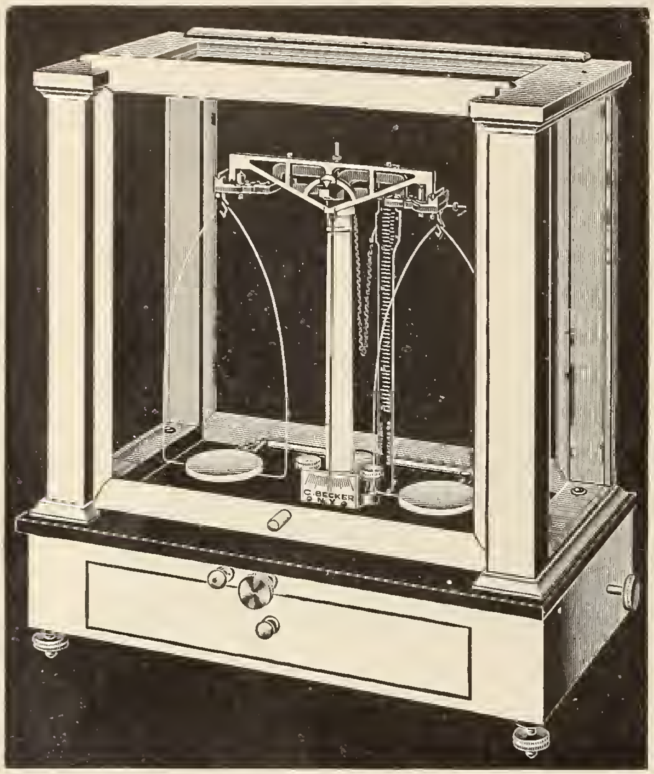
Vol. II, No. 1 | TORONTO, JANUARY, 1918 | 20c. a copy; $2 a year

PROFESSIONAL DIRECTORY



Analytical Chain Balance

INVALUABLE FOR RAPID WORK



The **chain balance** is of the usual construction of analytical balances, with the exception that there is no rider and consequently no graduations on the beam. All weighing below 50 m.g. to 1/10 m.g. is accomplished by lifting or lowering a small gold chain, suspended at one end from the beam, and at the other from a sliding hook attached to the graduated scale, from which direct readings are taken. To operate it is only necessary to rotate the thumb screw, conveniently placed outside the balance case, on the right hand side. (See illustration). This operation can take place while the beam is swinging, this in conjunction with the **elimination of all riders, and small weights below 50 m.g., resulting in a great saving of time.**

ANALYTICAL CHAIN BALANCE No. 15
With Vernier

Capacity	100 grams
Sensitiveness	1/20 milligram
Diameter of Pans	3 inches
Length of Beam	6 inches
Bearings	Agate
Knife edges	Agate
Capacity of bar and vernier	50 Mg. to 1/10 Mgm.

Polished mahogany case, front sliding frame, counterpoised. Mounted on black plate glass.

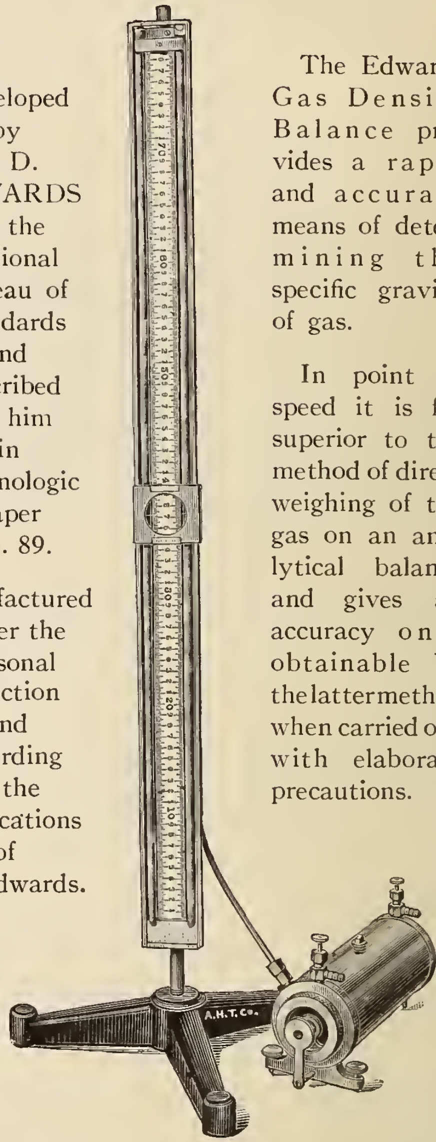
Price Duty Free) **$120.00**
" (Duty Paid) **175.00**

Above prices subject to advance without notice.

SALES AGENTS

LYMANS, LIMITED
344 St. Paul St. West MONTREAL

EDWARDS GAS DENSITY BALANCE



Developed by J. D. EDWARDS at the National Bureau of Standards and described by him in Technologic Paper No. 89.

Manufactured under the personal direction and according to the specifications of Mr. Edwards.

The Edwards Gas Density Balance provides a rapid and accurate means of determining the specific gravity of gas.

In point of speed it is far superior to the method of direct weighing of the gas on an analytical balance and gives an accuracy only obtainable by the latter method when carried out with elaborate precautions.

Price, complete with manometer and sufficient mercury for charging same, in carrying case **$100.00**

Complete Descriptive Pamphlet sent upon request.

ARTHUR H. THOMAS CO.
IMPORTERS—DEALERS—EXPORTERS
LABORATORY APPARATUS AND REAGENTS
West Washington Square Philadelphia, U.S.A.

CANADIAN CHEMICAL JOURNAL

A Canadian Journal devoted to Metallurgy Electro-Chemistry and Industrial Chemistry.

Vol. 2 TORONTO, JANUARY, 1918 No. 1

CANADIAN CHEMICAL JOURNAL

DEVOTED TO THE CHEMICAL AND METALLURGICAL INTERESTS OF CANADA.

Published monthly by the Biggar Press Limited

Office, 36 Toronto St., Toronto, Canada

Telephone Main 7399. E. B. BIGGAR, Managing Director

Subscription price, $2.00 per year to Canada, United States and all parts of the British Empire.

Time of going to press, 25th of the month preceding date of issue. News and changes of advertisements should be in hand one week before.

NOTICE

The Editorial Department of The Canadian Chemical Journal exercises every practicable care to ensure the correctness of the contents of the Journal. In the case of signed articles it is to be distinctly understood that the authors of such articles are alone responsible for the statements which they may contain of fact, opinion or conclusion. Address all editorial correspondence to 36 Toronto Street.

Principal Contents

THE publishers thank the readers who have kindly sent us back numbers of THE CANADIAN CHEMICAL JOURNAL. We have still more requests for back numbers to complete sets of the first volume. We shall be glad to pay the full price of any back number, except October, or we will credit two month's subscription for each copy sent to us, containing the reading matter in good condition.

Chemists and the Tribunals

THE labors of the tribunals established under the Military Service Act are over, so far as Class 1 is concerned, and it is possible to form some idea of their workings as these have affected chemists and metallurgists. First let us consider some facts.

The chairman of a Toronto tribunal, addressing a candidate for exemption, said: "We have been considering your case Mr. X, and owing to the well known shortage of chemists, we have decided to give you seven months' exemption, to be renewed indefinitely so long as you remain at your present or similar work." The following day the chairman of another Toronto tribunal said: "It is utter nonsense to talk about a shortage of chemists. You, Mr. Y., will be drafted; when you reach England, the British Government, which needs chemists, will doubtless pick you out and put you to chemical work."

The "well known shortage of chemists" had assuredly not been filled over night. If the British Government needs chemists why not send Mr. Y. to England at once? Why give him six months' military drill and leave it to chance for him and the British Government to make connection at the end of that time?

A tribunal at Kingston exempted the members of a class in metallurgy because they were needed to help in the production of steel but drafted their teacher of metallurgy "because he was needed in the trenches." Presumably the students will learn metallurgy by sitting in their class rooms and holding hands.

Probably the members of the tribunals are not so greatly to blame. As a whole they are able and well meaning men, with no scientific education, who are performing a thankless task. The cases cited above show that their task has been performed without guidance from the Government.

It is obviously absurd to urge greater production of food, metals, military equipment, explosives, etc., and to remove chemists and metallurgists whose services are essential to the production of war equipment and of fertilizers, steel, dyes, acids, glycerine, acetone, etc., etc. Scientific training has not heretofore been a distinctive feature of the equipment of

governments. The members of the present Government are neither worse nor better, in this respect, than their predecessors since Confederation. Lawyers, and that indefinite class known as "politicians," naturally come to the top in a democracy and the best one can hope for is that the members of the Government will realize their shortcomings in technical matters, and will consult experts who know what is essential and what non-essential in war organization.

What expert advice has been given to the Government as regards the Military Service Act and chemists? The "Advisory Council" may, or may not, have been consulted; on this point no public announcement has been made. Even if the Council were consulted its opinion would not have the weight that would come from the representations of a body of men directly representing the chemists of the Dominion.

There is still time for action to be taken. Let the authorities at least lay down the principles which should guide the Courts of Appeal in the disposition of chemists and metallurgists, including, of course, students in these subjects.

Chemists are, at least, as willing to perform military service as are the members of any class in the community, but they want to avoid waste and to be assured that their services, whether these be chemical or military, are being utilized in the most efficient manner, for the greatest good of the country.

Attention, Canadian Chemists

THE Ottawa Section of the Society of Chemical Industry will hold its annual meeting early in April and it is proposed to make this the occasion for holding in the capital the first Dominion convention of Canadian chemists, chemical engineers and metallurgists.

The striking industrial changes brought about by the war have deeply impressed the minds of public men and educationists with the need of raising Canada to a position of self-dependence in those industries that are based upon chemistry, metallurgy and kindred sciences. This, therefore, is that tide in the affairs of these sciences which should be taken at the flood if these vital industries are to be put on a sound foundation.

It is not merely organization, but driving force, or let us say, tractive power, that is needed. Knowledge is power alike in war and peace; and if, as is often said, this war is a chemists' war in an unprecedented degree, the peace to follow will also be a chemists' triumph.

To attract to these applied sciences the brightest young minds of the country is good national policy, for all work devoted to the chemical and metallurgical industries would be prodigal waste if they are not to be maintained and expanded in the new peace days to which we look forward.

We commend the proposed convention of chemists to the sympathy of all interested.

An announcement appears in our advertising pages. The hon. secretary of the society is Alfred Burton, 114 Bedford Road, Toronto; and the secretary of the Ottawa section is Joseph Race, city analyst, Ottawa.

Oleomargarine

THE oleomargarine industry has been started in Canada, two firms having been licensed to manufacture the product, and a large number of firms having had permission to import it. In a letter in this issue, Mr. Crown, who was chemist for a reputable margarine manufacturing firm in the United States, gives some useful and practical hints on the subject. Those interested will find in the Canada Gazette, of October 25th last, regulations governing the manufacture of margarine in Canada, and supplementary regulations may be had on application to the Food Controller, Ottawa. The application to manufacture, however, must be made to the Veterinary Director General, Ottawa.

International Water Powers

AT the annual meeting of the Commission of Conservation the chairman, Sir Clifford Sifton, urged that questions which have arisen in recent years regarding the use and division of water powers along the boundary between Canada and the United States be taken up now and settled through an international commission. This is timely and statesmanlike advice, and both governments will be wise in heeding it.

With a knowledge of what has befallen Europe no public man needs to be counselled as to the wisdom of avoiding war and so well has this been driven into public comprehension that it is now a commonplace to say that war between Canada and the United States is "unthinkable." But anyone who has read history knows that local events and acts prompted by selfishness, greed or bigotry may take on a national significance at any time—a recent example being the Cleveland-Venezuela misunderstanding—and the interests of private companies is a fruitful culture-bed of such trouble. The disputes of the power interests at Niagara Falls, involving a considerable hardship to some of the chemical industries there, are now before the public as a visible example.

There has been no period in the last hundred years so favorable as the present to an equitable settlement of such an important problem, for the immense benefits of international co-operation in the conduct of the war are palpably demonstrated, and both peoples realize the advantages of mutual accommodation in carrying on the industries as well as in commercial and governmental intercourse. An international treaty regarding the navigation of the

inland waterways of North America might also be taken up now as even more important.

There is a Joint Waterways Commission which has done valuable work in regard to international boundary water privileges, but the questions that have now arisen require adjustment from a new angle, and it is to be hoped that Sir Clifford Sifton's counsel will be promptly acted on.

It happens that the chemical and metallurgical interests of both countries will be specifically affected by an amicable settlement of these difficulties, for electro-chemical industries are the main creations of these water powers, the access to the markets of both countries giving these border sites a marked advantage. The bearing of such a settlement of these power questions on international good will is, however, the main problem.

The Halifax Calamity

THE catastrophe at Halifax, N.S., briefly reported in this issue, is unique in the annals of war, and since it is so remarkable as a manifestation of the power of modern chemicals, it might well be the subject of an investigation by a committee of scientists. The effects of the explosion upon the water, the air and the adjacent land will be a matter for speculation and inquiry for years to come.

There is one lesson which needs no enquiry to bring home to the authorities, and that is the culpable danger of turning a commercial harbor into a munitions depot. To most laymen it will seem strange that restrictions which are the rule in British seaports were not adopted in the handling of munitions at Canadian ports at the outbreak of war. No ships loaded with explosives are allowed in the Manchester ship canal, or at Liverpool docks, nor in the port of London, and vessels so laden have to show a sign when nearing a harbor. In the case of Halifax there are secluded inlets situated close to, but protected from, the city and its commercial port where nature provides harborage almost ready at hand, and St. John is equally well located for convenient and safe inlets.

A PROPOSAL was recently made to hold a second chemical exhibition in Chicago during the coming spring. The project has now been abandoned, and we think the directors of the National Exposition of Chemical Industries have acted wisely in dropping it. The firms who were willing to exhibit were not enough to make the venture a success, but apart from that practical difficulty it would seem to be better to have one annual show which would be really representative of the whole continent than to disperse the energies of the leaders in chemistry in too many directions.

High Explosives in the United States

In a note under the heading, "Shall We Burn Toluol or Shoot It?" the Journal of Engineering Chemistry says:

"Press accounts have shown clearly the amazing development of artillery fire during the past two months. The quintuple barrage, the wavelike and weaving barrage fire of the British artillery during the recent drives east of Ypres, have successfully driven the Germans steadily back and at a sacrifice of man-power amounting to only ten per cent. of the numbers estimated before the drives began.

"Of the several high explosives now in use, the War Department has pronounced tri-nitro-toluol (T.N.T.) as best. It is the easiest high explosive to make, and the safest to transport. For its manufacture toluol is required. At the present time we are producing annually approximately 11,000,000 gallons of toluol from the by-product retort coke ovens which have increased so rapidly in number since the war began. This quantity, however, is under contract for the supply of the Navy and our Allies. At least a year is required for the construction of a large battery of by-product ovens. For the new army the only quickly available source of toluol is the gas plants. A statement to that effect was made to us recently by Brigadier-General Wm. H. Crozier, the chief of the Bureau of Ordnance of the War Department. Gas plants can be equipped within three to four months, some more quickly, to remove the toluol from gas. By September, 1918, 22,000,000 gallons will be required for the American mobile artillery, but by better stripping methods that amount can be produced from the present gas plants."

Determination of Molybdenum in Ores and Concentrates

Now that so much attention is being paid to the development of molybdenum mines in Canada, the following method of determining the molybdenum in ores and concentrates, described by H. C. Mabee, chemist of the Department of Mines, Ottawa, will be of interest. Mr. Mabee reports that this method has been in satisfactory use for the past two years in the work of the department: Place from 0.5 to 1 gram of the sample in a quartz or platinum crucible of 50 c.c. capacity, add 2 to 3 c.c. fuming nitric acid, heat gently and evaporate just to dryness. Add 30 grams fused acid potassium sulphate and fuse. Leach out the fusion in hot water, heat to complete solution, precipitate the iron with ammonium hydroxide, settle, filter and wash with hot water. The precipitate should be examined for retained molybdenum and if necessary reprecipitate. To the ammoniacal filtrate add 50 c.c., 1 : 1 sulphuric acid. Pass through a special reductor made of half inch glass tubing, twenty-four inches long, drawn out at the lower end and connected by rubber tubing with a three inch funnel at the upper end. The reductor is filled with amalgamated zinc the size that will lie on a 10 mesh sieve. The lower end passes through a two hole stopper and about quarter the way to the bottom of a 1 litre gas bottle. By means of a piece of bent glass tubing passing through the second hole of the stopper, connection is made with a suction pump. Before making a reduction wash out the tube with hot 1 : 1 sulphuric acid solution. Place 20 c.c. of a 15 per cent. Ferric alum solution (made slightly acid with sulphuric acid) together with 20 c.c. "titrating mixture" in the gas bottle into which the reduced solution is passed. Wash out the reductor at least four times with the hot dilute sulphuric acid, filling the funnel each time. Titrate warm with standard Potassium Permanganate standardized against C.P. Molybdic acid (Baker's 99.9 per cent.) following the same procedure as in the case of an ore.

W. E. Segsworth, of the Seneca-Superior Mining Company, of Cobalt, has been appointed director of the Administration of Vocational Training for Returned Soldiers, recently created by the Dominion Government.

The Ottawa Water Supply

From a Chemical and Bacteriological Standpoint

By Joseph Race, F.I.C., City Bacteriologist and Chemist

The water supply for the City of Ottawa is entirely obtained from the Ottawa River, which forms the northern boundary of the city, at a point north-east of Lemieux Island, which is situated in midstream about 2,500 feet east of the western limit of the city. The drainage area of the Ottawa above this point is 36,420 square miles and yields an average flow of about 35,000 cubic feet per second with an average minimum of about 8,000 cubic feet per second.

The drainage area is almost entirely covered with the granitic formation and, as in the New England States, the run off is decidedly soft in character, the numerous outcrops of crystalline limestone being insufficient to appreciably harden the supply. Some of the lakes draining into the Ottawa contain considerably more temporary hardness, but the relative volume from these sources is small except during the spring floods when it is sufficient to increase the alkalinity by nearly 100 per cent. for a short period. As might be anticipated with a river having such a large flow, the chemical composition of the water is extremely stable, and after the spring thaws have subsided the quantity of matter in solution only varies a few parts per million from month to month. The effect of the spring thaws depends upon the rapidity with which the snow disappears: a slow gradual thaw decreases the color and slowly increases the alkalinity with but slight increments in the turbidity; quick thaws rapidly reduce the color but the alkalinity decreases for a few days and then often rises rapidly with a concomitant heavy increase in the turbidity. This is the only period of the year when the turbidity becomes noticeable to the consumers, but such excessive turbidities (over 300) apparently only occur in four or five year cycles.

A considerable number of muskeg swamps are located on the watershed and the drainage from these imparts a brown color to the water. Many people imagine that the color is due to the extensive logging operations that take place on the river, but this is incorrect as similar waters are to be found in the North of England, where logging is non-existent. Waters that are even more highly colored than the Ottawa are to be found in the States of Carolina, Virginia, and Florida. The color of the Ottawa supply averages about 40 parts per million (platinum cobalt scale), a value that is sufficiently high to render the color apparent in an ordinary glass tumbler; when seen in greater volume, as in a bath, the color makes the water æsthetically objectionable, whilst in a swimming pool it is sufficient to obscure objects on the bottom and in that way becomes a potential source of danger. Color cannot be satisfactorily removed by slow sand filtration and for that reason this type of purification is not suitable for the Ottawa River water. Fifteen to twenty per cent. of the color could be removed in this way, but the effluent from such a plant would still be dirty in appearance and a water that appears dirty would be stigmatized as generally dirty by the casual observer as that is the sole test by which such persons ordinarily judge water with which they are not perfectly familiar.

There is no definite evidence available that the color in the Ottawa is either increasing or decreasing as comparable records are only available for the past five years. During the last three years the color has been approximately stationary, except during the spring floods, and the figures for these years are somewhat less than for 1913-1914; it may be, however, that the figures for the earlier period are abnormally high. Numerous determinations of the color were made about thirty years ago by Dr. McGill, of the Inland Revenue Department of Ottawa, but as these were made with a Lovibond tintometer in which the color scale has since been changed, it is impossible to compare them with the present figures. Color is due to the presence of vegetable matter in solution which can be indirectly estimated by determining the albuminoid ammonia and the amount of oxygen consumed. In this way it is possible to obtain circumstantial evidence as to the color values of Dr. McGill's analyses and the following results seem to show that there has been no decrease or increase in the amount of organic matter in solution and consequently no material alteration in the color.

	Ottawa River McGill, March 25, 1890.	Ottawa River Race, March, 25, 1916
Nitrogen as		
Free Ammonia	0.006	0.010
Alb. Ammonia	0.090	0.090
Nitrites and Nitrates	0.089	0.050
Chlorine	1.5	1.5
Oxygen absorbed at 80°F. in		
15 minutes	3.47	3.33
4 hours	6.26	6.18
Mineral Matter	48	40

The above results are expressed in parts per million.

These analyses show that there has been no change in the composition and character of the Ottawa River above Ottawa during the last thirty years. It is interesting to note that the rapid increase in the population on the watershed has had no effect that could be found by delicate chemical analyses that can detect increments as small as one part in one hundred million parts in the organic nitrogen. The population per square mile has probably trebled during the period under consideration, but the general sewage pollution is insignificant by reason of the immense dilution it undergoes by the river water. It must not be assumed however that the sewage pollution can be safely ignored as that would be entirely misleading. Local pollution occurs at many places and renders the water quite unsuitable for domestic purposes in the raw condition. Where extensive local pollution occurs, chemical analyses would probably show considerable variations from the above results but in general the chemical results are of no sanitary value and resort must be made to the more delicate bacteriological methods for detecting sewage pollution.

It is unfortunate that there are no bacteriological results available until comparatively recently. During the past five years daily bacteriological examinations have been made in the Civic Laboratories and a mass of valuable bacteriological data has been accumulated. This shows that the Ottawa River at the mouth of the intake is invariably polluted, a condition that could be predicted from a sanitary survey of the river above the city. On the north shore of the river there is but little pollution except from the town of Aylmer (population, 6,000), which is about five miles above the Ottawa intake. This town is partially served with sewers which discharge into Lake Deschenes just above its outlet into the river at Deschenes Rapids. Until recently this town has had no provision for purifying its water supply and has consequently passed through several severe epidemics of typhoid fever. On the south, or Ontario shore, there is a scattered suburban population extending for several miles from the city limits and which has neither adequate water supply nor sewerage facilities. The water is entirely obtained from wells and the sewage often discharged into individual septic tanks. As the number of houses increases the septic tanks are contaminating the wells and the great majority of the latter is now heavily polluted. The population on the Ontario shore is largely increased in summer by a number of temporary residents and whilst these must always be a potential source of danger, there is no definite evidence that they have contributed to the incidence of typhoid either in Ottawa or in Hull which obtains its supply from the same channel as Ottawa. The logical development for the south shore is for absorption in the City of Ottawa, which would supply the whole district with water and sewerage systems.

The general pollution of the river is small and the B. coli con-

tent is low except during the spring floods when the river receives the washings from manured farms, and although there is abundant evidence that the river is occasionally infected with B. typhosus this condition should be somewhat ameliorated in the future when the recently constructed filter plant at Aylmer is placed in operation.* This plant should materially reduce the incidence of typhoid in Aylmer and consequently reduce the output of infected sewage.

The Ottawa River above the city is always more or less polluted and consequently potentially dangerous and should never be used as a domestic water supply without purification. Ottawa and Hull used this water for many years without treatment of any description but the typhoid rates of these periods bear eloquent testimony to the foolishness of such procedures. In 1911 and 1912 Ottawa suffered from severe epidemics but these were not the result of general infections of the river; they were caused by a break in a concrete section of the intake pipe. Since that time the water supply has been treated with bleach and the number of cases of typhoid developing in the city has gradually declined until the incidence now compares favorably with any city in North America. A conservative estimate of the lives saved in 1916 as compared with the years preceding the epidemics is about $50,000 per annum: a result that has been attained at the expenditure of about one quarter of that sum.

In the year following the epidemics the bleach solution was added to the intake pipe just before it enters the high lift pumping station and a dosage of 90 to 100 pounds per million gallons was required to secure the desired results. In 1913 a basin was built at the mouth of the intake pipe with the object of increasing the contact period, but it was found that better results could be obtained by eliminating the basin and discharging the bleach solution directly into the suctions of the low lift pumps. This ensured intimate mechanical admixture and prevented loss of hypochlorite through excessive local concentration. Various improvements were made from time to time as the result of laboratory studies and resulted in a reduction of the dosage to about 30 pounds per million gallons. Research work carried out in 1915 showed that more efficient results could be secured by the addition of dilute ammonia to hypochlorite and after this process had been worked out on a small plant in 1916 the method was put into operation in February of this year at the main plant where twenty million gallons per day are treated. At present only 15 pounds of bleach per million gallons are used together with 3.6 pounds of ammonia. The action of the ammonia is to combine with the hypochlorous acid, formed by the dissociation or hydrolysis of bleach in dilute solution, with the production of ammonium hypochlorite which undergoes spontaneous decomposition into chloramine (NH_2Cl) and water. $NH_4OCl = NH_2Cl + H_2O$. Chloramine is about 300 per cent. more efficient than chlorine as a gemicide, but has no oxidizing power and is consequently not absorbed and destroyed by the organic matter present in the water. This chloramine method of sterilization has given excellent results in Ottawa and also at Denver, Colorado, where it is being used by the Denver Union Water Company. At present it is impossible to prepare concentrated solutions of chloramine and consequently its sphere of utility is limited, but it is interesting to note that chloramine compounds of the aromatic series have been prepared and are now on the market. Chloramine T (toluene p-sulphochloramide) may be used as an ordinary germicide or for the sterilization of infected wounds by the Carrel method: halazone (p-sulphodichloraminobenzoic acid) has been recommended to the British Medical Research Committee for the treatment of small individual quantities of water such as are needed by cavalry or rapidly moving troops. Both of these compounds have been produced by Professor Dakin, of the University of Leeds.

* This plant has been put in operation since this article was written.

The bacteriological examinations of the river water exhibit many interesting points, the chief of which is the remarkably low total bacterial count as compared with the B. coli content. At the present time (October) the untreated river water is showing B. coli in a large percentage of the 1 c.cm. samples, although the total bacteria growing on agar in three days at 20°C. is considerably under one hundred, a figure that is regarded as the standard for pure waters in several European countries. It is also worthy of note that the majority of the organisma are gelatine liquifiers and that many are spore bearers and are consequently difficult to destroy by means of the usual germicides. At the present time no adequate explanation is forthcoming why ordinary water and sewage bacteria die out so rapidly in water of this character. A large number of the B. coli in the river water have been isolated and examined as to the type and the results show that the large majority is not of the true fæcal type: many are of the soil or grain type, which has generally been found to be more hardy than the true fæcal types.

The vegetable matter that produces the brown color in the Ottawa river water is not in true solution but exists as a colloidal suspensioid carrying a negative charge of electricity. The color particles are much too small to be removed by an ordinary filter, but they can be partially removed by filtration through pads made of fine asbestos fibre. It is inconceivable that the pores in the asbestos are smaller than the colloidal particles and the decolorising action must be attributed to some other agency; absorption may be one factor but it seems probable that some chemical action occurs that results in the coagulation of the color particles. The particles can be easily coagulated by the addition of an electrolyte and for this purpose basic aluminium sulphate is the most suitable. The aluminium cation carries a triple positive charge (Al^{+++}) of electricity which neutralizes or polarizes the negative charge on the color particles which then combine to produce masses sufficiently large to obey the ordinary laws of gravitation. In the dispersed phase the particles are exceedingly small and as they all carry the same kind of electricity they mutually repel one another and do not obey the law of gravitation. The amount of sulphate of alumina required to reduce the electro-static charge to the iso-electric point is largely controlled by the alkalinity as this stabilizes the disperse phase, and in practice it is usually found necessary to add sufficient to neutralize the bicarbonates present if the color is to be entirely removed.

When the outbreak of typhoid fever in Ottawa and its environs made the water supply of the capital a national problem, the city council decided to have its own chemist and bacteriologist and Mr. Race was appointed to ivestigate the water problem. It is suggested by Professor Bain that his method be made the standard for water analysis in Canada. Mr. Race is a graduate of the University of Birmingham, England, and a fellow of the Institute of Chemists.

There has been a large demand for fluorspar from the manufacturers of open hearth steel, who use it as a flux. As is well known to chemists, it is also in demand for making hydrofluoric acid, and a new use is as a reagent in the making of potash from feldspar and in the recovery of potash from Portland cement clinker. It is also used in the extraction of aluminium from bauxite. Attention is being given to the fluorspar deposits of Central Ontario, and the Wallbridge mine at Madoc is among those now shipping.

The Canada Cement Company, Montreal, are making preparations to manufacture potash as a by-product of their cement mill. Their large output of cement will enable them to recover considerable potash from the flue dust, etc. The experts of the ompany are now considering which of several processes available will be used.

The Bread Problem

By Chas. E. Saunders, Ph.D., Dominion Cerealist

In view of the statements made by some of the witnesses who appeared before a committee of the Senate last July, to discuss the question of whole wheat and other kinds of bread, and in view of the article on White versus Grey Bread, by Mr. A. J. Banks, in the October number of THE CANADIAN CHEMICAL JOURNAL, I wish to call attention to some of the facts and to draw some conclusions from them.

1. The only human digestion experiments that have been made to compare flour containing 80 per cent. of the wheat with ordinary white flour, were carried out by Professor Wood, of Cambridge, England. He concluded that the two flours are of practically equal food value in so far as protein and energy are concerned, the 80 per cent. containing, however, twice as large a quantity of assimilable phosphates.

2. Professor Snyder made no experiments with 80 per cent. or 82 per cent. flour. The nearest he came to it was when using fine meal containing some bran (the so-called "entire wheat flour"). This material was about 86 per cent. of the wheat. He found it less digestible than ordinary white flour due no doubt, he says, to its lack of fineness.

3. Professor Snyder also studied a mixture of 14 parts of finely ground bran with 86 parts of ordinary flour, in comparison with the ordinary flour alone. These tests showed that not only did the addition of the bran not hinder the digestion of the flour, but that the bran itself yielded 10 per cent. of digestible protein and 40 per cent. of digestible carbohydrates. I am fully aware that Professor Synder does not point this out in the bulletins in question (Bul. No. 156, Office of Exp. Stations, U.S. Dept. of Agr.). In fact, he seems to look at the matter quite otherwise. But the figures he gives prove my statements. Over fifty per cent. of the finely ground bran was digested, and I do not see in the bulletin any statement that digestive disorders occurred.

So much for the experimental side of the question. Now let us have some facts about war-time experiences in Belgium and France.

4. In the article above referred to by Mr. Banks, he gives the impression, and in his evidence before the Senate Committee (p. 53) he clearly states that the bread which produced such unfortunate results among the Belgian children was of 81 or 82 per cent. extraction. He says he is quoting from Mr. Hoover's account. Thinking there must be an error here, I wrote to Mr. Hoover and received a very lucid reply from one of the officers of the Belgian Relief Commission to whom my letter was transferred. The following extract from the reply is of interest: "The only statement which Mr. Hoover made in regard to the effect of the flour distributed by the Commission for Relief in Belgium upon the health of the recipients was to the effect that wheat ground at a milling percentage of 90 per cent. or higher was found to be detrimental to the health of the Belgian people." I am further informed that even 97 per cent. extraction was tried—of course with very bad results. It is to be observed that both the 97 per cent. and the 90 per cent. flours contained quite a quantity of bran which was moderately coarse. As long as the milling percentage was fixed at 82 (for good wheat and as low as 75 for wheat of inferior quality) the intestinal and stomach disease among the Belgian people were at the (pre-war) normal. It should be noted also that this 82 per cent. flour was not used pure, but was mixed with about 10 per cent. of rye or maize flour. No doubt pure 82 per cent. wheat flour would have made still better bread.

5. In France, recently, wheat flour of 85 per cent. extraction, on all grades of wheat, has been tried with unsatisfactory results, and the people are complaining. This flour is not all finely ground but contains some coarse products.

6. Monsieur S. M. Girard recently stated in one of the French agricultural journals that before the war the ordinary bread used in rural communities of France was of 80 per cent. extraction.

Professor Snyder is reported as having said, in one of his recent addresses, that the assumption is being made "that the present uses of the wheat by-products give little or no return as human food." I have not yet met anyone who makes that assumption. Such individuals should not be allowed to be at large. Prof. Snyder, when he speaks about the proper division of wheat products between men and animals so that the greatest possible amount may be "utilized jointly" seems to forget that we are not a joint-stock company in which the animals are equal partners with ourselves. The question at issue is not, In what way can we secure the digestion of the largest amount of material by man and animals jointly? But, in what way can we secure the digestion of the largest amount of material by man? Leaving aside milking cows, whose product we require in any case, we lose enormously when we feed to an animal, food, which is wholesome for human beings and, which could have been utilized directly by them. The animals return to us, as meat, not more than one quarter of the food they consume. Surely Professor Snyder does not assume, as he appears to do, that we get a return of 100 per cent.

From the facts above stated, and from my own experience with various kinds of flour, including the 80 per cent.—which, by the way, makes excellent bread—I have reached the following conclusions: It is clear that any bread—however coarse—is perfectly wholesome for most people, if properly made from good wheat products and if eaten only in rather small quantities. But it is equally clear that flour which contains even a moderate proportion of coarse particles of bran is not fit to form a large part of the diet of all people—especially of young children. If it is to be used extensively and indiscriminately the bread must be made from flour not meal. Such flour may certainly contain up to 80 per cent. of the wheat, and probably several per cent. higher (I refer to plump wheat, of course). The exact limit is unknown, but we do know that 80 per cent. is quite safe, and that the 80 per cent. flour is, on the whole, a more advantageous food than flour of lower percentage extraction.

It is wasteful to feed any more than 20 per cent. of our wheat products to animals; and I sincerely hope that the production of 80 per cent. flour will soon be made compulsory in Canada.

Ottawa, December, 1917.

New Publications

EXAMINATION OF WATER, BY WM. P. MASON. Size, 5×7¼. Pages, 186. Cloth. Fifth Edition. Price, $1.25. Published by John Wiley & Sons, New York.

The author of this work, who is also author of "Water Supply," a standard work recently reviewed in this JOURNAL, deals in the present work with both the chemical and bacteriological examination of water. While giving to each department of examination its proper weight, he points out that their value is only relative, and that these two methods although each in themselves are essential, are only aids in the interpretation of the formal question, "Is this a safe water supply?" This is not a beginner's book, and the author presupposes the reader to have some knowledge of chemistry and bacteriology, therefore, in many places the merest suggestions are given. It is a valuable book to the engineer interested in domestic and commercial water supply.

We welcome to our exchange table a new journal, "The Color Trade Journal," started this year in New York, with offices at 200 Fifth Avenue. It is published monthly at $5.00 a year, or $5.75 to Canadian subscribers. It is largely devoted to the dyeing industry, specializing on textiles and paper, giving 64 pages of interesting matter on dyestuffs and their application.

High Explosive Primers

By Guy B. Taylor

(By permission of the Director of the U.S. Bureau of Mines)

An explosive may be defined as any system of solids or liquids capable of exothermal transformation into gases by application of a suitable exciting agent. This definition at once excludes the large number of known gaseous explosive systems, since such systems have little or no value in accomplishing the particular work an explosive is designed to perform. Obviously the reason lies in the impracticability of condensing sufficient gaseous matter into the small space required.

Explosives are generally divided into two classes: first order, or "low" explosives, and second order, or "high" explosives. Black powder and smokeless powder are typical representatives of the first order; dynamite and trinitrotoluene are high explosives. Low explosives are characterized by the comparative slowness with which they burn or explode. Hign explosives detonate, releasing their energy in a very short space of time. They possess a property called brisance, which conveys a very definite meaning to explosive men, but has as yet received no precise definition. Brisance is concerned largely with the time factor. Brisant explosives deliver enormous momentary blows, rupturing the strongest steel in which they may be confined. Low explosives on the other hand burn from layer to layer, with increasing rapidity as the pressure of the gaseous products of explosion increases; hence their value as propellants of projectiles in guns.

Another distinction between the two classes of explosives is the manner in which they must be ignited in order to secure effective work from them. Low explosives may be ignited by any source of heat at high temperature, such as a flame from a percussion cap, or a hot wire. High explosives on the other hand require strenuous measures.

The early development of high explosives was due almost entirely to the indomitable perseverance of the Swedish engineer, Alfred Nobel. He became convinced that nitroglycerine which had been discovered many years previously by the Italian chemist, Sobrero, had remarkable possibilities for industrial uses. After the many difficulties of manufacture with safety had been overcome, there remained the two problems of transporting it without danger and making it explode when required. The first difficulty was overcome by absorbing the liquid in the porous material, kieselguhr, and the second by the introduction of the fulminate primer, in 1864.

In early methods of exploding nitroglycerine, the liquid was placed in a hole bored in the solid rock and a comparatively large wooden or metallic case containing a mixture of black powder and nitroglycerine was suspended below the surface by means of a black powder fuse. This relatively large priming charge fired by the fuse sometimes detonated the main charge and often did not. Nobel then discovered that much smaller charges of mercury fulminate mixed with black powder, saltpeter, or potassium chlorate were much more effective. From that day up to the present, mercury fulminate has held its position practically undisputed as the essential ingredient of all high explosive primers.

In 1869, Sir Frederick Abel published his famous wave synchronism theory to account for the almost unique property possessed by mercury fulminate of causing high explosives to detonate. This theory for lack of a better was largely accepted until Wohler's experiments published in 1907. Abel found that the very brisant explosives, nitrogen chloride and iodide, were ineffective primers for nitroglycerine and gun cotton. The action of fulminate he ascribed to synchronism between the explosion waves of the primer and main charge.

Wohler investigated eight explosives, including mercury fulminate for their priming properties. They were mercury fulminate, silver hydronitride (or azide), trimercuryaldehyde chlorate and perchlorate, diazobenzene nitrate, nitrogen sulfide, sodium fulminate, and mercury nitromethane. The first four only possessed priming properties. Will and Lenze had previously found lead hydronitride to be an efficient primer, but their work was kept secret by the German war office.

Wohler's work was followed by a large number of proposals for substituting other explosives for the hitherto exclusively used mercury fulminate. Among these may be mentioned salts of hydronitric acid (HN_3), salts of persulphocyanic acid, nitropentaerythritol, hexanitroethane, hexamethylene-diperoxyd-diamine, nitrodiazobenzene perchlorate, lead trinitroresoncinate, benzoyl peroxide, lead picrate, hexanitro diphenylamine, and silver acetylide. Some of the organic compounds in the above list possess high priming efficiencies, but do not appear to have been commercially manufactured. The preparation of such exceedingly sensitive compounds is hazardous at best and manufacturers are loth to engage in it. Long experience in the making of fulminate has made its manufacture well understood and not particularly dangerous. It answers practically all requirements as a primer and there seems to be no immediate need for replacing it.

The modern detonator for blasting explosives consists of a drawn copper shell 5 to 10 mm. in diameter and 20 to 50 mm. long. These are usually filled with 1 to 2 grams of mercury fulminate or its mixtures with potassium chlorate. Some detonators are manufactured by superimposing small charges of fulminate upon secondary explosives such as tetryl in the detonator shell, thus economizing on fulminate.

Mixtures of fulminate containing up to 20 per cent. $KClO_3$ are probably more efficient than straight fulminate and are used in blasting caps in most countries except France. Such mixtures are slightly more hydroscopic than straight fulminate so that the latter is preferred for military uses. A very small amount of moisture renders a detonator useless.

The properties of priming explosives are remarkable. A few grams of any of them slightly confined and exploded in contact with high explosives will set up an explosion wave causing thousands of pounds to explode. As a more concrete example, suppose in a magazine or mine there are several thousand pounds of trinitrotoluene. A small copper shell two inches long and about as large as a lead pencil is buried in the TNT. Into this shell is put 1 gram of tetryl (tetranitromethylaniline), a fuse attached to shell and lighted. The fuse burns down to the shell, spits its flame against the tetryl and nothing whatever happens. Now suppose we leave the system just as it is except that .05 gram of lead hydronitride is pressed in the shell on top of the tetryl, a new fuse attached and ignited. When the flame reaches the lead hydronitride, the detonator explodes the whole charge, raising tons of rock and earth into the air.

To the lay mind, the power of explosives to produce destructive effects leads to much exaggeration; as, for instance, the invention recently reported by the press of an explosive so powerful that a small pellet would destroy the Woolworth Building. This is, of course, absurd. In this connection, it may be well to point out that the effects secured from explosives depend upon the short time in which their energy is released and not upon their energy content. Burning a pound of coal releases much more energy than the explosion of a pound of any explosive. This explains why the use of explosives in internal combustion engines, as has sometimes been proposed, is foredoomed to failure.

The theory now in vogue to explain the peculiar action of initial primers may be called the acceleration theory. In order to detonate a high explosive it appears to be necessary to start the explosion by a very sudden and intense blow. In order to bring this about a primary explosive must be used having a detonation velocity of thousands of meters per second. When fulminate is ignited it first burns, but in a short space of time, said to be not more than one three-thousandth of a second, the

maximum detonation velocity sets in. Only those explosives which possess this power of enormously accelerating their own explosive decomposition are effective high explosive primers.

Industrial Uses of Aluminium

By F. G. Shull

(From a paper before the American Institute of Metals, Boston, Mass.)

Among the uses of aluminium the writer referred to the following materials practically all of which have become of commercial importance during quite recent years:

Aluminium foil, aluminium bottle caps and jar closures; manufactures, involving autogenous welding; die and pressed castings; tubing for store service; rolled rod for machining purposes, and aluminium conductors, steel reinforced.

The aluminium foil industry has grown from practically nothing to a volume of business involving many tons of aluminium annually. At that start, the product consisted principally of plain foil, not appreciably unlike plain tin foil in appearance, which was used for wrapping candies, chewing gum, teas and the like. Later on the development of the process for embossing and printing aluminium foil opened up a large field among manufacturers of chocolate bars, cheese, toilet soaps, etc., so that to-day a very considerable tonnage of this foil is being used in the embossed and printed form.

Plain foil is being used to some extent in electrical condensers. A most recent use for plain foil, which has, as yet, just barely started, is for the lining of pulp-board cartons for the packing of coffee. This combination package possesses moisture resisting and oil retaining characteristics not inferior to the tin can, as a coffee container.

Aluminium bottle caps and jar closures on the market, known as the "Goldy" seal, have, like foil, advanced from a meagre beginning to a business of substantial proportions during a very few years. They are being used on practically all food products put up in glass, such as grape juice, fruits, preserves, ketchup, pickles, salad dressing, and so on. While this seal posesses the non-refillable feature and requires no opener to remove ,it owes its success, in a great degree, to the fact that it is aluminium, which is known to be non-rusting and strictly hygienic.

The development of a process of welding aluminium by means of the oxy-hydrogen and oxy-acetylene flame has opened an almost limitless field for the outlet of aluminium. Sheet aluminium of all gauges heavier than about 1/32 of an inch can be readily welded and the seam dressed off so that it is difficult to locate the joint. Consequently it is possible to build up an aluminium tank or container of almost any size and shape which, when welded together, is practically a one-piece job. This class of material finds a place in breweries, ginger-ale plants, milk depots, chemical plants, and, in fact, wherever seamless metallic non-rusting containers are wanted. The one-piece feature is of marked advantage over the riveted tank, which is always liable to spring a leak.

For a long time it has been considered a difficult proposition to die-cast aluminium. At the present time, however, this problem seems to have been solved, as there are several companies that claim to be successfully die-casting this metal.

Another quite recent development is the subjecting a sand castings to very high pressures in order to render the metal more dense and to increase the strength. Such castings have found use in the making of parts for the timing devices of shrapnel, it being found that these castings not only possess extra high strength, but that they also machine exceptionally well.

Aluminium tubing for pneumatic store service is not a new field for aluminium, strictly speaking, since it has been gradually coming into use for the past several years. It is a fact, however, that the last few years have seen the volume of aluminium consumed for this purpose reach a stage where the tonnage involved is of very great importance. The natural characteristics of the metal itself principally recommend it for this use.

One of the most interesting developments in the aluminium industry of recent years is the rolling of high alloy rods in practically all commercial sizes. In the past, commercial aluminium rod has been largely a drawn product. This method of manufacture prevented the use of aluminium alloyed with any appreciable percentage of other metal, for the reason that in the drawing operation the surface, principally, of the rod is worked. The result is that the surface becomes hard, while the body of the rod is left comparatively soft. Therefore, only the smaller sizes of drawn rod are suitable for machining.

By the rolled method of manufacture not only is it possible to use highly alloyed metal, but also the process tends to work the entire mass of the rod so that the finished product is a good uniform homogeneous material which machines well throughout its entire substance. This process, therefore, makes available a good machining aluminium rod in all commercial sizes for automatic machines and turret lathe products.

One of the first uses for which this rolled rod was tried was for the machining of the fuse-timing parts for shrapnel. While it worked perfectly for this purpose, it so happened that the principal timing parts were of such a shape that in making them from rod it was necessary to cut away a great deal of the metal, resulting in high scrap loss. It was found that sand castings of the general shape of the parts to be made could be subjected to a compression process and rendered highly satisfactory for this purpose, with a minimium of scrap loss. Consequently, as a commercial proposition, the rolled rod could not compete with the compressed castings for this particular article. It will, without doubt, however, find wide usage for automatic machine products.

Aluminium cable, steel reinforced, is not a very recent aluminium product, it having been in commercial use on an extensive scale for the past few years. It is, however, sufficiently little understood to seem to warrant reference being made to it under the title of this paper.

The excuse for the existence of such a product as steel reinforced aluminium cable lies in certain inherent characteristics of aluminium which needed improvement in order to recommend its use for long span, high voltage work. The particular characteristic to which I refer is the coefficient of expansion of aluminium, which is approximately one-third greater than that of copper. Due to this great expansion, the aluminium line lengths a little more with temperature rise, and shortens a little more with temperature fall, than copper. The result is that it is necessary to string aluminium wire with greater sags than copper wire in order that its strength may not be overtaxed at low temperatures. By allowing this greater sag at ordinary temperatures, combined with the higher coefficient of expansion of the aluminium referred to, one is apt to get excessive sags at extremely high temperatures in summer.

This was a condition of comparatively little importance in the early days of low voltages and short spans, but with the advent of higher voltages and long spans, steel tower construction, the characteristics of aluminium cable, as referred to above, became a serious menace to its commercial existence.

What aluminium cable lacked was high tensile strength and low coefficient of expansion. In order to impart these characteristics it was proposed to make the centre strand of a 7-strand cable, of steel and the six outer strands, of aluminium, the steel to furnish the strength and the aluminium, the electrical conductivity. A very high grade plow steel wire was selected, which was triple galvanized to prevent corrosion, and the practical tests which followed proved that the theory was correct; that the composite cable took on characteristics different from either of the component metals, and was highly satisfactory for long span work.

It is found feasible to construct these cables with any standard number of strands, varying the proportion of steel and aluminium to meet the particular strength and sag conditions required.

Aluminium cable, steel reinforced, began to grow in favor from the start, so that to-day many of the most modern transmission lines on the American continent are built with this cable.

This, in a general way, will give a hint as to some of the more recent uses of aluminium. The automobile industry is, of course, the big factor in the aluminium business to-day, but the relative importance of some of the other fields for this metal seem to be greatly on the increase.

Industrial Research Scholarships

Editor Canadian Chemical Journal:

Sir,—Under the heading of "Industrial Research Scholarships," an editorial appeared in your November issue expressing certain ideas that I feel should not go unchallenged in the name of Canadian chemists and Canadian universities.

The factors which will make Canada, chemically speaking, independent of Germany after the war, are factors over which she has very little control. However valuable chemical independence may be as an ideal for Canada, it is much more likely that the war will be over before we have made more than a few faltering steps in that direction. The time has certainly arrived, and may indeed be somewhat overdue, for us to more intensely investigate and realize the value of our own particular natural resources which may be developed and improved by the application of chemical principles. It is exceedingly difficult for the small boy to run off and play in his own back yard. That immediately becomes work, or in our case, applied chemistry.

It would be very unfortunate if the Dominion Government were making such a grave mistake as is suggested by your editorial. It is not too much to ask that a man who even calls himself a research student should at least hold a Bachelor's degree. Nor is it at all likely that any man whose time is nominally given to research work shall cease to be a student. Independent study, which is the only kind that leaves a residue on evaporation, develops perhaps for the first time under such conditions.

A further general misconception seems to exist, and is well voiced in the article under discussion, that all Canadian Universities are at present, and always have been in the past, utterly unable to teach a chemist anything after he holds a Bachelor's degree. It has been always presupposed that a research student attached to a Canadian University would be doing worse than wasting his time. He should go, and keep on going, if not to Germany any more, at least to the United States. Certain benefits are to be obtained by a student from attending more than one university. There are, however, at least three universities in Canada which are able now, and have been able in the past, to give courses in chemistry and the sciences, easily on a par with those which may be obtained in any American university. I have personal friends among the recent graduates of at least half a dozen of the leading American universities and, besides comparing the courses they offer, I have attended lectures and have done post graduate research work in one of the best. In the light of my experience and observation I would consider it a very wise move not only for the Canadian Government, but for any other government to attach students, whom they wish to train in research principles, to our own Canadian universities. Any chemist knows that there is no particular virtue in a PhD. degree. It may or may not signify research ability. This is particularly true of the machine-like grinding out of degrees in some highly praised foreign universities.

It may be true enough that our Canadian univeristies have not in the past advertised post graduate courses in chemistry very extensively, but that does not mean that they were not teaching post graduate work of an exceedingly high order to those who wished it. This statement may surprise some but it is true, that courses in chemistry are offered to fourth year students at Toronto University of a more advanced nature than are given in any other American university, even to post graduate students. Here the basic principles of chemistry are placed on the sure foundation of thermodynamics and mathematics. Is teaching of such a quality likely to create a lop-sided mentality in a research student?

It may be granted at once that the "cook book" methods of analysis do not receive the same attention from some Canadian universities that they do in other places. These form a large part of those so called "intensive and advanced courses of work," so highly praised elsewhere. But I maintain, and it has been proved many times, that any chemist who can read English, visit a library, and work a German dictionary on occasion, can by himself, in a very short time, learn how to determine "tin and lead in condensed milk," if required, or any other such mechanical operation.

It has been my experience in the past few years, while watching graduates from Canadian unversities go out to positions all over the United States and Canada, that their minds have been particularly adapted to research work. This I take it was largely due to that peculiar training they had received in what might be termed the advanced fundamentals of chemistry and science, and to the fact that they reached their new positions not as the masters of a trade, using mechanical methods, short cuts of analysis, and well memorized formulæ; but rather because their basic principles were sound, and upon these they could create new clear thought for themselves. If it is the ability to impart wisdom plus inspiration that counts, our own institutions stand second to none.

It seems to me then that the time has surely come, when instead of belittling ourselves, and the value of our own institutions, we should aim for fair play in their behalf, and throw in for good measure a little boost. Lacking in this it is only natural that our own public, and our international friends, should take us at our own advertised value. The right student will bridge the gap between the theoretical and the applied industrial in chemistry just as well starting from McGill, Queen's, or Toronto, as he ever will starting from Columbia, Harvard, Cornell, Illinois, Chicago, or California.

L. E. WESTMAN.

Ottawa, December 7, 1917.

Spontaneous Combustion in Coal

A committee of the National Electric Light Association has been collecting data regarding the weathering and spontaneous combustion of stored coal. The conclusion of the committee is that for complete protection of coal from spontaneous heating the only sure method to-day is the storage of coal under water. This method is used by the United States Government at its coaling stations on the Panama Canal, by the Western Electric Company in Chicago, and in other places. The objections to this method are the moisture contained in the reclaimed coal and the liability of freezing in localities where low temperatures prevail. Apparently there has been no authenticated case of spontaneous combustion in lump coal, but the danger is greatest where there is a large proportion of slack. Artificial treatment with specific chemicals or solutions intended to act as deterrents does not offer great encouragement, though some results seem to warrant further trial.

There is a report current that the Durham Cement Company, of Durham, Ont., are developing a new process of potash recovery, but The Canadian Chemical Journal is informed that there is no truth in this report.

The Complexity of the Chemical Elements*

By Prof. Frederick Soddy, M.A., F.R.S.

(Concluded from December Number)

Thorium and Ionium

A second quite independent case of a difference in atomic weight between isotopes has been established. It concerns the isotopes thorium and ionium, and it is connected in an important way with the researches which, on two previous occasions, I have given an account of here, the researches on the growth of radium from uranium, which have been in progress now for fourteen years. It is the intervention of ionium and its very long period of life which has made the experimental proof of the production of radium from uranium such a long piece of work. Previously only negative results were available. One could only say, from the smallness of the expected growth of radium, that the period of average life of ionium must be at leas 100,000 years, forty times longer than that of radium, and, therefore, that there must be at least forty times as much ionium by weight as radium in uranium minerals, or at least 13.6 grms, per 1,000 kilos. of uranium. Since then further measurements, carried out by Miss Hitchins last year, have shown definitely for the first time a clear growth of radium from uranium in the largest preparation, containing 3 kilos. of uranium, and this growth, as theory requires, is proceeding according to the square of the time. In three years it amounted to $2 \times 10_{-11}$ grms. of radium, and in six years to just four times this quantity. From this result it was concluded that the previous estimate of 100,000 years for the period of ionium, though still of the nature of a minimum rather than a maximum, was very near to the actual period.

Joachimsthal pitchblende, the Austrian source of radium, contains only an infinitestimal proportion of thorium. An ionium preparation separated, by Auer von Welsbach, from 30 tons of this mineral, since no thorium was added during the process, was an extremely concentrated ionium preparation. The atomic weight of ionium—calculated by adding to the atomic weight of its product, radium, four for the a-particle expelled in the change—is 230, whereas that of thorium, its isotope, is slightly above 232. The question was whether the ionium-thorium preparation would contain enough ionium to show the difference. Honigschmid and Mlle. Horovitz have made a special examination of the point, first redetermining as accurately as possible the atomic weight of thorium and then that of the thorium-ionium preparation from pitchblende. They found 232.12 for the atomic weight of thorium, and by the same method 231.51 for that of the ionium-thorium. A very careful and complete examination of the spectra of the two materials showed for both absolutely the same spectrum and a complete absence of impurities.

If the atomic weight of ionium is 230, the ionium-thorium preparation must, from its atomic weight, contain 30 per cent. of ionium and 70 per cent. of thorium by weight. Prof. Meyer has made a comparison of the number of a-particles given per second by this preparation with that given by pure radium, and found it to be in the ratio of 1 to 200. If 30 per cent. is ionium, the activity of pure ionium would be one-sixtieth of that of pure radium, its period some sixty times greater, or 150,000 years. This confirms in a very satisfactory manner our direct estimate of 100,000 years as a minimum, and incidentally raises rather an interesting question.

My direct estimate involves directly the period of uranium itself, and if the value accepted for this is too high, that for the ionium will be correspondingly too low. Now, last week, Prof. Joly was bringing before you, I believe, some of his exceedingly interesting work on pleochroic halos, from which he has grounds for the conclusion that the accepted period of uranium may be too long. But since I obtained, for the period of ionium, a minimum value two-thirds of that estimated by Meyer from the atomic weight, it is difficult to believe that the accepted period of uranium can have been overestimated by more than 50 per cent. of the real period. The matter could be pushed to a further conclusion if it were found possible to estimate the percentage of thorium in the thorium-ionium preparation, a piece of work that ought not to be beyond the resources of radio-chemical analysis. This would then constitute a check on the period of uranium as well as on that of ionium. Such a direct check would be of considerable importance in the determination of geological ages.

The period of ionium enables us to calculate the ratio, between the weights of ionium and uranium in pitchblende, as 17.4 to 109, and the doctrine of the non-separability of isotopes leads directly to the ratio, between the thorium and uranium in the mineral, as 41.7 to 109. This quantity of thorium is, unfortunately, too small for direct estimation. Otherwise it would be possible to devise a very strict test of the degree of non-separability. As it is, the work is sufficiently convincing. Thirty tons of a mineral containing a majority of the known elements in detectable amount, in the hands of one whose researches in the most difficult field of chemical separation are world renowned, yield a preparation of the order of one-millionth of the weight of the mineral, which cannot be distinguished from pure thorium in its chemical character. Anyone could tell in the dark that it was not pure thorium, for its a-activity is 30,000 times greater than that of thorium. This is then submitted to that particular series of purification designed to give the purest possible thorium for an atomic weight determination, and it emerges without any separation of the ionium, but with a spectrum identical with that of a control specimen of thorium similarly purified. The complete absence of impurities in the spectrum show that the chemical work has been very effectively done, and the atomic weight shows that it must contain 30 per cent. by weight of the isotope ionium, a result which agrees with its a-activity and the now known period of the latter.

Determination of Atomic Weights

The results enumerated thus prove that the atomic weight can no longer be regarded as a natural constant, or the chemically pure element as a homogeneous type of matter. The latter may be, and doubtless often is, a mixture of isotopes varying in atomic weight over a small number of units, and the former then has no exact physical significance, being a mean value in which the proportions of the mixture as well as the separate atomic weights are both unknown. New ideals emerge and old ones are resuscitated by this development. There may be after all a very simple numerical relation between the true atomic weights. The view that seems most probably true at present is that while hydrogen and helium may be the ultimate constituents of matter in the Proutian sense, and the atomic weights therefore approximate multiples of that of hydrogen, small deviations, such as exist between the atomic weights of these two constituent elements themselves, may be due to the manner in which the atom is constituted, in accordance with the principle of mutual electro-magnetic mass, developed by Silberstein and others. The electro-magnetic mass of two charges in juxtaposition would not be the exact sum of the masses when the charges are separated. The atomic weight of hydrogen is 1.0078 in terms of that of helium as 3.99, and that the latter is not exactly four times the former may be the expression of this effect. Harkins and Wilson have recently gone into the question with some thoroughness, and the conclusion of most interest in the present connection, which appears to emerge, is in favor of regarding most of the effect to occur in the formation of helium from hydrogen, and very little in subsequent aggregations of the helium. In the region of the radio-elements, where we have abundant examples of the expulsion of helium atoms as a-particles, it seems as if we could almost safely neglect this effect altogether. Thus radium has the atomic weight almost

*Lecture delivered at the Royal Institution, May 18, 1917.

exactly 226, and the ultimate product almost exactly 206, showing that in 5-a and 4 β-ray changes the mean effect is nil, and the atomic weights are moreover integers in terms of oxygen as 16, or helium 4. It is true that the atomic weights of both thorium and uranium are between 0.1 and 0.2 greater than exact integers, but it is difficult to be sure that this difference is real.

When, among the light elements, we come across a clear case of large departure from the integral value, such as magnesium, 24.32 and chlorine, 35.46, we may reasonably suspect the elements to be a mixture of isotopes. If this is true for chlorine it suggests a most undesirable feature in the modern practice of determining atomic weights. More and more the one method has come to be relied upon: the preparation of the chloride of the element and the comparison of its weight with that of the silver necessary to combine with the chlorine, and with the weight of the silver chloride formed.

Almost the only practical method, and that a very laborious and imperfect one, which may be expected to resolve a mixture of isotopes, is by long-continued fractional gaseous diffusion, which is likely to be the more effective the lower the atomic weight. Assume, for example, chlorine were a mixture of isotopes of separate atomic weights, 34 and 36, or 35 and 36. The 34 isotope would diffuse some 3 per cent. faster than the 36, and the 35 some 1.5 per cent. faster.

The determination of the atomic weight of chlorine in terms of that of silver has reached now such a pitch of refinement that it should be able to detect a difference in the end fractions of the atomic weight of chlorine, if chlorine or hydrogen chloride were systematically subjected to diffusion. It is extremely desirable that such a test of the homogeneity of this gas should be made in this way.

Clearly a change must come in this class of work. It is not of much use starting with stuff out of a bottle labelled "purissimum" or "garantirt," and in determining to the highest possible degree of accuracy the atomic weight of an element of unknown origin. The great pioneers in the subject, like Berzelius, were masters of the whole domain of inorganic chemistry, and knew the sources of the elements in Nature first-hand. Their successors must revert to their practice and go direct to Nature for their materials, must select them carefully with due regard to what geology teaches as to their age and history, and, before carrying out a single determination, they must analyse their actual raw materials completely, and know exactly what it is they are dealing with. Much of the work on the atomic weight of lead from mixed materials is useless, for failure to do this. They must rely more on the agreement, or disagreement, of a great variety of results by methods as different and for materials as different as possible, rather than on the result of a single method pushed to the limit of refinement, for an element provisionally purified by a dealer from quite unknown materials. The preconceived notion, that the results must necessarily agree if the work is well done, must be replaced by a system of co-operation between the workers of the world checking each other's results for the same material. A year ago anyone bold enough to publish atomic weight determinations, which were not up to the modern standards of agreement among themselves, would have been regarded as having mistaken his vocation. If these wider ideals are pursued, all the labor that has been lavished in this field, and which now seems to have been so largely wasted, may possibly bear fruit, and where the newer methods fail, far below the narrow belt, of elements which it is possible to watch changing, the atomic weight worker may be able to pick up the threads of the great story. No doubt it is writ in full in the natural records preserved by rock and mineral, and the evidence of the atomic weights may be able to carry to a triumphant conclusion, the course of elementary evolution, of which as yet only an isolated chapter has been deciphered.

The Structure of the Atom

The third line of recent advance, which does much to explain the meaning of the isotopes and the Periodic Law, starts from Sir Ernest Rutherford's nuclear theory of the atom, which is an attempt to determine the nature of atomic structure, which again is the necessary preliminary to the understanding of the third aspect in which the elements are or may be complex. That uranium and thorium are built up of different isotopes of lead, helium, and electrons is now an experimental fact, since they have been proved to change into these constituents. But the questions how they are built up, and what is the nature of the non-radiactive elements, which do not undergo changes, remain unsolved.

Prof. Bragg showed in 1905 that the a-particles can traverse the atoms of matter in their path almost as though they were not there. As far as he could tell, and the statement is still true of the vast majority of a-particles colliding with the atoms of matter, the a-particle ploughs its way straight through, pursuing a practically rectilinear course, losing slightly in kinetic energy at each encounter with an atom, until its velocity is reduced to the point at which it can no longer be detected. From that time the a-particle became, as it were, a messenger that could penetrate the atom, traverse regions which hitherto had been bolted and barred from human curiosity, and on re-emerging could be questioned, as it was questioned, effectively by Rutherford, with regard to what was inside. Sir J. J. Thomson, using the electron as the messenger, had obtained valuable information as to the number of electrons in the atom, but the massive material a-particle alone can disclose the material atom. It was found that, though the vast majority of a-particles re-emerge, from their encounters with the atoms, practically in the same direction as they started, suffering only slight hither and thither scattering due to their collisions with the elctrons in the atom, a minute proportion of them suffer very large and abrupt changes of direction. Some are swung round, emerging the opposite to their original direction. The vast majority, that get through all but undeflected, have met nothing in their passage save electrons, 8,000 times lighter than themselves. The few that are violently swung out of their course must have been in collision with an exceedingly massive nucleus in the atom, occupying only an insignificant fraction of its total volume. The atomic volume is the total volume swept out by systems of electrons in orbits of revolution round the nucleus, and beyond these rings or shells guarding the nucleus it is ordinarily impossible to penetrate. The nucleus is regarded by Rutherford as carrying a single concentrated positive charge, equal and opposite to that of the sum of the electrons.

Chemical phenomena deal almost certainly with the outermost system of detachable or valency electrons alone, the loss or gain of which conditions chemical combining power. Light spectra originate probably in the same region, though possibly more systems of electrons than the outermost may contribute, while the X-rays and γ-rays seem to take their rise in a deep-seated ring or shell around the nucleus. But mass phenomena, all but an insignificant fraction, originate in the nucleus.

In the original electrical theory of matter, the whole mass of the atom was attributed to electrons, of which there would have been required nearly 2,000 times the atomic weight in terms of hydrogen as unity. With the more definite determination of this number, and the realization that there were only about half as many as the number representing the atomic weight, it was clear that all but an insignificant fraction of the mass of the atom was accounted for. In the nuclear hypothesis this mass is concentrated in the exceedingly minute nucleus. The electro-magnetic theory of inertia accounts for the greater mass if the positive charges that make up the nucleus are very much more concentrated than the negative charges which constitute the separate electrons. The experiments on scattering clearly indicated the existence of such a concentrated central positive charge or nucleus.

The mathematical consideration of the results of a-ray scatter-

ing, obtained for a large number of different elements, and for different velocities of a-ray, gave further evidence that the number of electrons, and therefore the +charge on the nucleus, is about half the number representing the atomic weight. But van der Broek, reviving an isolated suggestion from a former paper full of suggestions on the Periodic Law, which were, I think, in every other respect at fault, suggested that closer agreement with the theory would be obtained if the number of electrons in the atom, or the nuclear charge, was the number of the place the element occupied in the Periodic Table. This is now called the atomic number, that of hydrogen being taken as 1, helium 2, lithium 3, and so on to the end of the table, uranium 92, as we now know. For the light elements it is practically half the atomic weight; for the heavy elements rather less than half.

I pointed out this accorded well with the law of radio-active change that had been established to hold over the last thirteen places in the Periodic Table. This law might be expressed as follows: The expulsion of the a-particle carrying two positive charges lowers the atomic number by two, while the expulsion of the β-particle, carrying a single negative charge, increases it by one. In ignorance of van der Broek's original suggestion, I had, in representing the generalization, shown the last thirteen places as differing unit by unit in the number of electrons in the atom.

Then followed Moseley's all-embracing advances, showing how from the wave-lengths of the X-rays, characteristic of the elements, this conception explained the whole Periodic Table. The square roots of the frequency of the characteristic X-rays are proportional to the atomic numbers. The total number of elements existing between uranium and hydrogen could thus be determined, and it was found to be ninety-two, only five of the places being vacant. The "exceptions" to the Periodic Law, such as argon and potassium, nickel and cobalt, tellurium and iodine, in which an element with higher atomic weight precedes instead of succeeds one with lower, was confirmed by the determination of the atomic numbers in every case. From now on this number, which represents the +charge on the nucleus, rather than the atomic weight, becomes the natural constant which determines chemical character, light and X-ray spectra, and, in fact, all the properties of matter, except those that depend directly on the nucleus—mass and weight on the one hand, and radioactive properties on the other.

What, then, were the isotopes on this scheme? Obviously they were elements with the same atomic number, the same net charge on the nucleus, but with a differently constituted nucleus. Take the very ordinary sequence in the disintegration series, one a- and two β-rays being successively expelled in any order. Two + and two − charges have been expelled, the net charge of the nucleus remains the same, the chemical character and spectrum the same as that of the first parent, but the mass is reduced 4 units because a helium atom, or rather nucleus, has been expelled as an a-particle. The mass depends on the gross number of +charge in the nucleus, chemical properties on the difference between the gross number of + and − charges. But the radioactive properties depend not only on the gross number of charges but on the constitution of the nucleus. We can have isotopes with identity of atomic weight, as well as of chemical character, which are different in their stability, and mode of breaking up. Hence we can infer that this finer degree of isotopy may also exist among the stable elements, in which case it would be completely beyond our present means to detect. But when transmutation becomes possible such a difference would be at once revealed.

The case is not one entirely of academic interest, because it is possible that the reconciliation of the conflicting views of the geologists and chemists, who concluded that lead was not the ultimate product of thorium, and those who by atomic weight demonstrations on the lead have shown that it is, depends probably on this point.

As has long been known, thorium-C, an isotope of bismuth, disintegrates dually. For 35 per cent. of the atoms disintegrating, an a-ray is expelled followed by a β-ray. For the remaining 65 per cent. the β-ray is first expelled and is followed by the a-ray. The two products are both isotopes of lead, and both have the same atomic weight, but they are not the same. More energy is expelled in the changes of the 65 per cent. fraction than in those of the 35 per cent. Unless they are both completely stable a difference of period of change is to be anticipated.

The same thing is true for radium-C, but here all but a very minute proportion of the atoms disintegrating follow the mode followed by the 65 per cent. in the case of thorium-C. The product in this case, radium-D, which, of course, is also an isotope of lead, with atomic weight 210, is not permanently stable, though it has a fairly long period, 24 years. The other product is not known to change further, but then, even if it did, it is in such small quantity that it is doubtful whether the change would have been detected. But, so far as is known, it forms a stable isotope of lead of atomic weight 210, formed in the proportion of only 0.03 per cent. of the whole.

Now the atomic weight evidence merely shows that one of the two isotopes of lead formed from thorium is stable enough to accumulate over geological epochs, and it does not necessarily follow that both are. Dr. Arthur Holmes has pointed out to me that the analysis I gave of the Ceylon thorite leads to a curiously anomalous value for the age of the mineral. The quantity of thorium lead per grm. of thorium is 0.0062, and this divided by the rate at which the lead is being produced, 4.72×10^{-11} grm. of lead per grm. of thorium per year, gives the age as 131 million years. But a Ceylon pitchblende, with uranium 72.88 per cent. and lead 4.65 per cent., and ratio of lead to uranium as 0.064, gives the age as 512 million years. Dr. Holmes regards the two minerals as likely to be of the same age, and the pitchblende to be, of all the Ceylon results the one most trustworthy for age measurement.

If we suppose that, as in the case of radium-D, the 65 per cent. isotope of lead derived from thorium is not stable, and that only the 35 per cent. isotope accumulates, the age of the mineral would be 375 million years, which the geologists are likely to consider much more nearly the truth. But the most interesting point is that, if we take the atomic weight of the lead isotope derived from uranium as 206.0, and that derived from thorium as 208.0, and calculate the atomic weight of the lead in Ceylon thorite, assuming it to consist entirely of uranium lead and of only the 35 per cent. isotope from thorium, we get the value 207.74, which is exactly what I found from the density, and what Prof. Honigschmid determined (207.77).

The question remains, if this is what occurs, what does this unstable lead change into? If an a-particle were expelled mercury would result, or if a β-particle bismuth, two elements of which I could find no trace in the lead group separated from the whole 20 kilos. of mineral. But if an a- and a β-particle were both expelled, the product would be thallium, which is present in amount small but sufficient for chemical as well as spectroscopic characterization. If the process of disintegration does proceed as suggested, it should be possible to trace it, for this particular lead should give a feeble specific a- or β-radiation, in addition, of course, to that due to other lead isotopes. So far it has not been possible to test this. In the meantime, the explanation offered is put forward provisionally as being consistent with all the known evidence.

Looking for a moment in conclusion at the broader aspects of the new ideas of atomic structure, it seems that though a sound basis for further development has been roughed out, almost all the detail remains to be supplied. We have got to know the nucleus, but beyond the fact that it is constituted, in heavy atoms, of nuclei of helium and electrons, nothing is known. Whilst as regards the separate shells or rings of electrons which neutralize its charge and are supposed to surround it, like the shells of an onion, we really know nothing yet at all. The original

explanation, in terms of the electron, of the periodicity of properties displayed by the elements, still remains all that has been attempted. We may suppose, as we pass through the successive elements in the table, one more electron is added to the outermost ring for each unit increase in the charge on the nucleus, or atomic number, and that when a certain number, 8 in the early part of the table, 18 later, a complete new stable shell or ring forms, which no longer participates directly in the chemical activities of the atom. Thanks, however, to Moseley's work, this now is not sufficiently precise; for we know the exact number of the elements, and the various atomic numbers at which the remarkable changes, in the nature of the periodicity displayed, occur. Any real knowledge in this field will account not only for the two short initial periods, but also for the curious double periodicity later on, in which the abrupt changes of properties in the neighborhood of the zero family alternate with the gradual changes in the neighborhood of the VIIIth groups. The extraordinary exception to the principle of the whole scheme presented by the rare-earth elements remains a complete enigma, none the less impressive because, beyond them again in the table, the normal course is resumed and continues to the end.

Hints on Oleomargarine Manufacture

Editor Canadian Chemical Journal:

Sir,—Having been connected with the oleomargarine industry in the United States, I have read with interest the articles on oleomargarine appearing in your journal, impressed at the time that the clear exposition of the facts must surely aid the movement to establish the industry in Canada. Now that the objective has been gained, your Journal may be of further service to the new industry by publishing additional helpful data from time to time, and a brief outline of the experience of some manufacturers in the United States may be of some value just now.

At the present time three general kinds of oleomargarine are manufactured in the United States.

1. White goods, the color of which generally is a creamy white.

2. Tinted goods, the color of which is similar to that of butter, produced by the natural color of the oils and by the addition of creamery butter, and

3. Colored goods, having a yellow color, produced by the addition of coloring matter, generally annatto.

The first two are subjected to a Governmental tax of ¼ cent per pound, but the last is taxed 9¾ cents, in addition to the ¼ cent general tax. Needless to say that on this account, there is less of it produced, than of the other two grades. In the early days of the industry, there wasn't much, if any, white goods sold, but at the present time, owing to the persistence and educational work of the manufacturers, the public has been greatly converted to the purchase of the white product. Although this grade of goods contains no butter, its quality, due to the improved methods of manufacture, is superior to that of the tinted goods in which creamery butter is incorporated, and its cost is usually about 2 or 3 cents less per pound. A capsule of butter color,—a vegetable substance similar to that used in coloring butter—is supplied to the consumer with every pound. The procedure of coloring is very simple. The oleomargarine is spread out in a large bowl or on a flat surface (a platter or bread board), the capsule, containing about 8 or 9 drops of the coloring matter, is punctured and the contents dropped on various parts of the mass, which is then worked in from the edges by means of a wide wooden spatula in the same manner that dough is kneaded. In less than five minutes the color is evenly distributed and the oleo is ready for the table.

The following incident is illustrative of the resemblance of oleomargarine to butter. Some of our white goods was submitted to a large creamery for appraisal. The oleo and some of the creamery's choicest butter were colored to the same shade and then made into prints of similar appearance. They were then submitted, unmarked, to five or six butter experts, who were requested to pick out their own product. After tasting and smelling both, and comparing the physical properties, a a majority of them picked the oleomargarine as being the butter.

An unfortunate feature of the early days of the industry was the sale by unscrupulous retailers of colored and tinted oleomargarine as butter, and at the price of butter, this occurring in spite of stringent Federal and State laws. However, the practice has been practically eliminated through the activity of the Government, and because of the increased demand for the white goods. Enclosed you will find a copy of the Oleomargarine law of the State of Illinois.

All factories in the United States in which oleomargarine is manufactured are licensed by the Federal Government and have an inspector, chosen by the Bureau of Animal Industry, on the premises at all times during manufacture. It is his duty to examine all materials entering into the product and to see that the hygienic and sanitary conditions are up to a high standard.

The actual handling of the product by the workers is reduced to a minimum, all the manipulation being done mechanically. The goods are handled only once and that when wrapped by girls wearing clean white gloves, and clad in aprons and caps. The cleanliness and care taken in the process of manufacture are the marvel of all visitors to the factories, where the public is always welcome and willingly conducted through.

The above statements may seem irrelevant to a chemical journal, but since you have taken up the scientific discussion in previous numbers this may make a fitting sequel.

H. A. CROWN.

67 Sheridan Ave., Brantford, Ont.

The German Patents Question

Editor Canadian Chemical Journal:

Sir,—I have read with much interest the editorial appearing in your December issue dealing with flotation process patents which are controlled by Germans. It is to be hoped that the attitude of the Government in regard to German patent processes and trade marks will soon undergo a change as at present their unwillingness to assist Canadian industries by cancelling the German rights is a great hardship.

Our company, which is engaged in the manufacture of acetyl salicylic acid, phenacetine, and other fine chemicals formerly produced exclusively in Germany or under German control, has approached the Government on several occasions requesting that it be allowed to use the word "Aspirin," which is the registered name for acetyl salicylic acid and is the property of Germans.

This request is refused, the reasons assigned by the Government for their unwillingness to grant the request are summed up in the following formal announcement:

"No action has been taken under "The War Measures Act" to suspend or cancel Trade Mark Registrations standing in the name of alien enemies, as the use by a Canadian of the trade mark of a foreigner, would lead the public to believe that they were obtaining the imported article, when, as a matter of fact, they were being supplied with a Canadian substitute for such article and consequently deception would arise."

There appears to us to be no good ground for such an argument in as much as while we are compelled to market our product under the name of acetyl salicylic acid it is universally known to the trade as "Aspirin," and is so sold by all retailers. Furthermore this product together with all other enemy goods is prohibited under severe penalties to be imported into Canada.

We feel the stand of the Government to be unjust and we hope that immediate steps will be taken to release all enemy patents to be used for the benefit of Canadian enterprises.

Chemical Products of Canada, Limited.
G. G. Grover.

Carbonization of Canadian Lignites

Edgar Stansfield, M.Sc., and Ross E. Gilmore, M.Sc.

In spite of enormous deposits of coal, many parts of Canada are inadequately supplied with fuel. The industrial development of the country has apparently taken place largely without regard to the coal supply, or, more strictly, has developed with regard only to a coal supply from the States. Moreover, certain large deposits of coal in the prairie provinces are difficult of utilization, being low grade fuel. An investigation, having for its object the efficient use of such low grade fuels, is now being carried on by the Mines Branch of the Department of Mines. This paper deals with a part of this investigation.

The problem of coal supply in southern Saskatchewan and Manitoba is serious, and yet possible of prompt solution on account of the Souris lignite coal field in that district. Because of the above, and because lignite from this district is particularly low grade, Souris coal has been chosen for first consideration.

An analysis of a carload sample of coal recently received in Ottawa from the Shand mine near Estevan in the Souris field is given below; and, for purposes of comparison, analyses are also given of Phalen seam coal from the Sydney field and of a typical anthracite sold in Ottawa.

Table No. 1

Comparison of Three Coals

	Shand	Sydney	Anthracite
Moisture	34.6%	3.5%	3.9%
Ash	8.6	5.7	11.2
Volatile matter	24.9	33.1	
Fixed carbon	31.9	57.7	
Calorific value, calories per gram	3,795	7,510	7,005

Even if we recalculate the calorific value of the Shand coal to a moisture-free basis we get only 5,805 calories per gram.

The low calorific value of the Souris coal is, however, not its chief drawback. The coal as mined consists of large lumps, but contains some 30 per cent. of water. Thus for every 100 tons of dry coal shipped, handling charges and freight have also to be paid on some 43 tons of water. Moreover, when the coal is burned in a furnace this water has to be evaporated and sent up the chimney with a consequent great loss of efficiency. If, on the other hand, the coal is stored, it gradually loses a large part of its contained moisture, but in so doing the lumps crack and crumble until the product is almost useless for ordinary purposes.

Methods for increasing the commercial value of this coal are easy to suggest. For example, it could be dried, powdered, and briquetted. Unfortunately, unlike German brown coal, it is so deficient in inherent binding material that a briquette made without the addition of a binder will not stand storage and handling; whilst briquetting with the addition of a binder is an expensive operation considering the low grade of the material to be treated. The briquettes moreover are so high in volatile constituents that they tend to disintegrate as soon as they are heated. Another suggestion would be to carbonize the coal and use the residue briquetted or otherwise. The volatile matter driven off from the coal by heat has a lower calorific value per gram than has the original coal, so that the residue is a higher grade fuel. The coal, however, does not soften and coalesce when heated, or, in other words, does not coke, so that the product is a friable material bearing somewhat the same relation to the original that charcoal does to wood. This carbonized residue could be used in gas producers, or as powdered fuel, or, with the addition of a suitable binder, could be briquetted and employed generally as a fuel.

Much work has been done in different parts of the world on the utilization of lignites, and one must conclude from the results obtained that at present the most hopeful treatment for the Souris lignite is low temperature carbonization, with recovery of by-products, and the briquetting of the residue with addition of a binder. In this connection it may be mentioned that it has long been known to fuel specialists that a truly economical use of most bituminous coals necessitates a preliminary carbonization with recovery of by-products. The importance of this is now very widely understood, and it is reported that the direct combustion of coking coals is prohibited in Germany.

Although, as stated above, much work has been done on the utilization of lignites, as far as the writers are aware comparatively little exact information has yet been published on the carbonization of lignites. This lacuna we are endeavoring to fill.

Points which it was considered a systematic investigation should elucidate, included the following. When a sample of lignite is carbonized what influence on the results have:—the final temperature to which it is heated, the rate of heating, the duration of heating, the pressure under which it is heated, and the atmosphere in which it is heated? The results to be examined included the yield and calorific value of the carbonized residue, the yield and calorific value of the gas generated, and

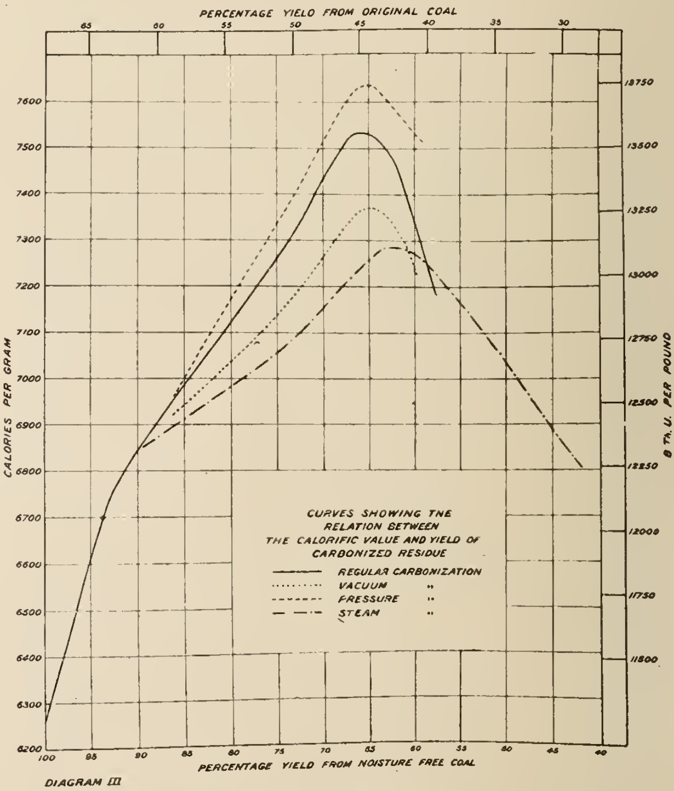


Diagram 3

the yield and economic value of the tar and other by-products produced.

Practical difficulties make the exact temperature control desired impossible on any but small samples; yet the yields of gas and by-products from such small samples are too small for study. It was, therefore, decided to study first the effect of the above conditions on the yield and calorific value of the residue from small samples, and to study later the by-products in a series of experiments on a larger scale. The first series of tests is now practically completed, the methods employed and the results obtained being stated below.

Experiments

Coal.—The particular coal chosen for these experiments was, by the advice of the Saskatchewan Government, taken from the Shand Mine of the Saskatchewan Coal Brick and Power Company. The sample, which consisted of a single lump of coal shipped by express from the mine in a wooden box, was

crushed, and then ground to a fine powder in a ball mill. For convenience of manipulation, and as a prevention against the rapid change which a powdered coal undergoes owing to moisture loss and oxidation, this powder was briquetted in a small hand press. The briquettes were cylindrical, ¼ in. diameter, about ¼ in. long, and ran about 5 or 6 to the gram. They were stored in stopped weighing bottles until required, and from time to time control moisture determinations were made upon them. It might be noted that during a period of two months the moisture content fell only 1 per cent. from an original of over 30 per cent.

The average analysis of this coal was: Moisture, 31.75%; Ash, 5.20%; Volatile Matter, 28.05%; and Fixed Carbon, 35.00%. Its gross calorific value was 4,296 calories per gram.

Apparatus.—The apparatus used for most of the experiments consisted of a cylindrical iron retort 1½ in. high and 1½ in. diameter, inside measurement, having a lid which was held on by a small clamp, the joint being rendered air-tight by means of an asbestos gasket. A small inlet tube was screwed into the bottom of the crucible, and an outlet tube into the lid; the inlet and outlet tubes being so arranged that the retort could be completely immersed in an oil or lead bath. For the experiments under pressure a slightly larger and heavier retort was employed, the lid being held by 6 bolts, and rendered gas-tight with an asbestos-copper gasket. The inlet tube was dispensed with, and a pressure gauge and relief valve connected to the outlet tube.

The coal briquettes employed in each test were weighed out into a 10 gram capacity quartz crucible which fitted inside the iron retort. The heating was done by immersing the retort in a bath, which for tests up to 300°C. was of oil and for those above that temperature of lead. The lead was contained in a 4 in. length of 4 in. iron pipe with a cap end, and was heated in a gas fire furnace which gave a very uniform temperature throughout the bath, and which permitted of rapid heating and easy control. The temperature was followed by two pyrometers immersed in the lead.

The pyrometers employed were calibrated from time to time by means of the freezing points of lead and zinc. The recorded temperatures are probably correct to within 5°C.

Procedure.—The general procedure, modified in the particular cases noted, was as follows: From 3 to 10 grams of the briquetted sample was weighed out into the quartz crucible; this was placed in the iron retort and the top clamped down. A gentle stream of dried coal gas was passed in through the inlet tube to displace the air, the gas was then cut off and the retort immersed in the bath of oil or lead previously heated to about the desired temperature. The progress of carbonization was watched by causing the evolved gas to bubble through a little water; it was thus found that one and a half hours was sufficient to complete the operation. In every case after the lead bath had been finally adjusted to the desired temperature, this temperature was maintained for at least half an hour. At the end of the experiment the retort was taken out of the bath and cooled as rapidly as possible, cold water being run over it to complete the cooling. A little dried coal gas was also passed through the apparatus during this period to prevent the oxidation of the hot product by air drawn in as the gases contracted. When quite cold the retort was opened and the quartz crucible weighed to determine the loss in weight of the briquettes during the experiment. The calorific value of the carbonized briquettes was then determined by means of a Riche adiabatic calorimeter using a platinum resistance thermometer.

The water content of the original briquettes was determined by heating for one and a half hours in a toluol oven in a stream of carbon-dioxide. By means of this the results obtained above were recalculated to a moisture-free basis.

For reasons given below it was found necessary to standardize the conditions, especially the time factor, in all operations with the dried or carbonized residue. The quartz crucible and contents were always weighed in a stoppered weighing bottle. The residue at the close of an experiment was weighed as soon as cold to determine the loss in weight, and the portion required for the calorimeter was weighed out by difference as nearly as possible fifteen minutes after stopping the heating.

Calculations and Curves

For each test the loss in volatile matter was determined by subtracting the weight of the moisture in the sample taken from the observed loss, the result being expressed as a percentage of the equivalent weight of dry coal. This is referred to as the percentage loss of weight (volatile matter) on a moisture-free basis. It should be noted that water originally present in the coal is not regarded as "volatile matter" in the technical use of that phrase, although water produced by the decomposition of the coal is included in the volatile matter.

In diagram 1 the loss of volatile matter is shown plotted against the temperature at which the experiment was carried out; a separate curve being shown for each of the series of tests described below. In a few cases the points given represent the average of two or more results. Diagram 1 also shows the calorific value, in calories per gram, of the carbonized residue from each test, these values being similarly plotted against the temperature of carbonization.

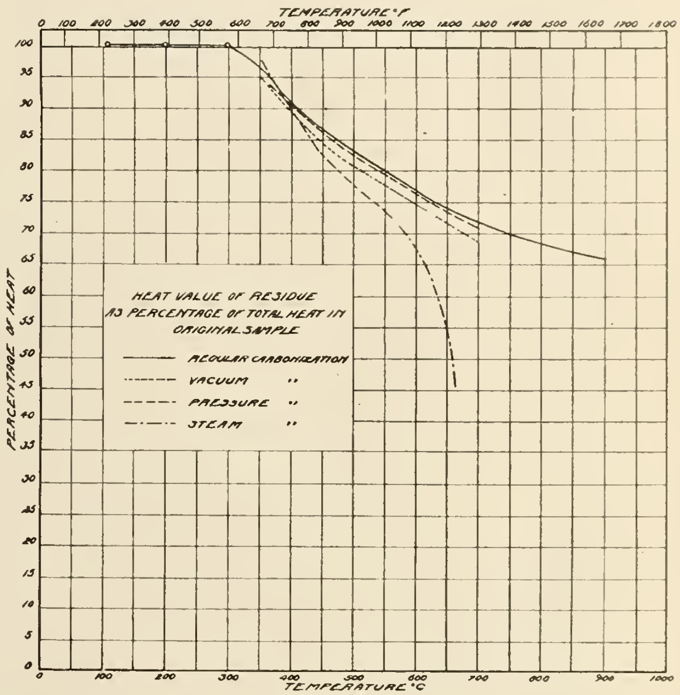


Diagram 2

Diagram II shows the total heat value of the carbonized residue expressed as a percentage of the total heat values of the corresponding weight of the original sample, plotted against the temperature of carbonization. This diagram may, therefore, be described as showing the thermal efficiency of the process with respect to the residue. The curves given are deduced from the rounded curves in diagram I.

Diagram III shows the calorific value of the carbonized residue plotted against the yield; the yields being shown as percentages of both the original coal and the moisture-free coal. These curves are also deduced from the rounded curves in diagram 1.

Table II shows the summarized results of all the tests. For ease of comparison, the results given are taken from the rounded curves in the diagram at definite temperature intervals.

All results have been calculated to a moisture-free basis as

described above. This gives a more stable basis for comparison, as the moisture in the coal as received is liable to show considerable variation. It is also a more satisfactory basis when it is desired to compare results with coals from different sources. The figures given in Table III have been calculated to correlate the above results with the more commercial values; that is, of the above results expressed on the basis of the coal as received. This table shows the relation between the actual loss on carbonization expressed as a percentage of the original coal, the deduced loss of volatile matter on the moisture-free coal basis, and the calculated analysis of the carbonized residue. The calorific values are taken from the curve for the regular series of tests.

The residue from a moisture determination, in an atmosphere of carbon dioxide in a toluol oven, is taken as the moisture-free basis for all calculations and curves, it being assumed that no volatile matter is driven off at 110°C. In the calculations for Table III, the percentage of volatile matter found by the standard method of determination is assumed to be the total volatile matter in the coal. The regular series curve in diagram I indicates that this is approximately correct. It is also assumed that if a certain fraction of the volatile matter in a sample is

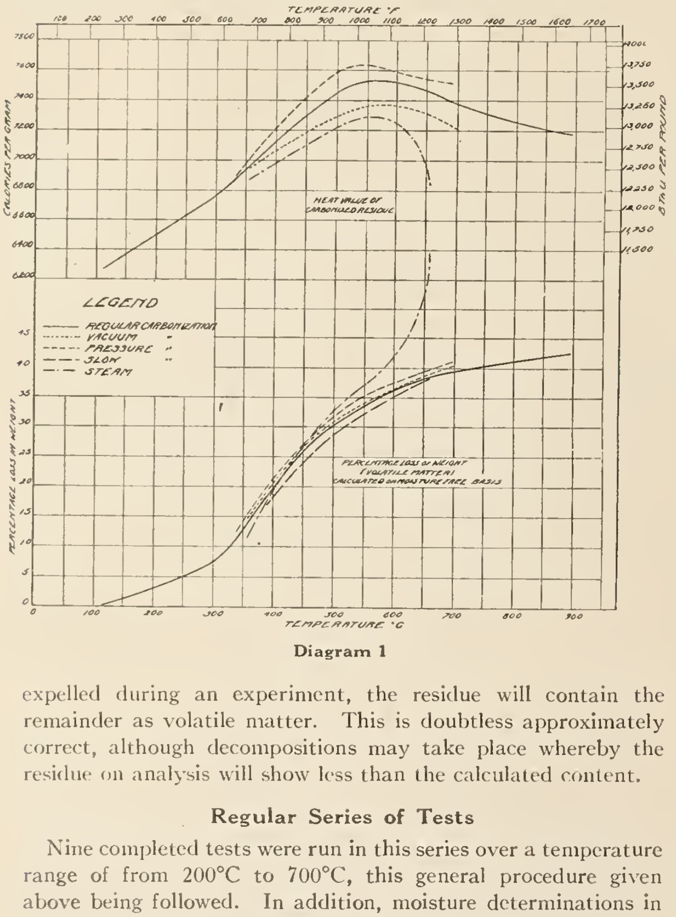


Diagram 1

expelled during an experiment, the residue will contain the remainder as volatile matter. This is doubtless approximately correct, although decompositions may take place whereby the residue on analysis will show less than the calculated content.

Regular Series of Tests

Nine completed tests were run in this series over a temperature range of from 200°C to 700°C, this general procedure given above being followed. In addition, moisture determinations in the toluol oven were regarded as giving the comparable results for a temperature of 110°C, and standard volatile matter determinations, in a platinum crucible over a gas flame, the results for a temperature of approximately 900°C.

The results obtained, as shown in the curves, indicate that the loss of volatile matter is slight up to 300°C. From there up to 600°C. the loss increases rapidly, and by 700°C. the volatile matter has nearly all been driven off. The calorific value of the residue increases steadily up to 550° to 600°C., and then commences to decrease.

A very striking phenomenon, first observed in connection with the vacuum series, was later found to take place with every sample of dried or carbonized lignite. The residue in every case rapidly gained in weight after removal from the retort even when stored in a desiccator over sulphuric acid; its calorific value at the same time decreasing. The results given in the curves and in the tables are, with the exceptions noted, for weights and calorific values determined immediately after the experiment. When the tests described in this report were first made, the calorimetric determinations were not carried out immediately, the delay in some cases being as much as two or three days. The loss in calorific value on standing, however, was so serious that it was found necessary to repeat all the more important experiments with the time factor standardized as already described. As an example of the above:—one sample, carbonized at 550°C. in the regular series, which was stored in a desiccator, for the first 4½ hours in a closed weighing bottle and afterwards in a specimen tube closed with a rubber stopper, showed gains in weight of 0.05% in 1½ minutes, 0.2% in 4½ hours, 0.4% in 3 days, 1.6% in 16 days, and 2.2% in 26 days. The losses in calorific value were 2.6% in 16 days and 3.8% in 26 days. The losses in calorific value are apparently slightly greater than can be accounted for by occlusion of air or unavoidable absorption of moisture. Study of this phenomenon is reserved for later investigation, as the results obtained are insufficient for reliable interpretation.

Slow Carbonization Series

Six completed tests were run in this series over a temperature range of from 390°C. to 700°C. The procedure was the same as in the regular series, except that, instead of the retort being heated rapidly up to the desired temperature, it was first heated to about 250°C. in the oil bath, then transferred to the lead bath, and its temperature slowly raised to the required point.

The results show a strong similarity to those of the regular series, but for any given final temperature, slow heating caused a slightly lower loss of volatile matter. The calorific values were rather erratic but showed no marked difference from the above. It should be noted in this and the following cases that even where the yields and the calorific values are similar in two series, it is no indication that the by-products are also alike. As has already been stated, the by-products are to be examined in a later investigation. This series was not repeated after the standardization of the time factor. The calorific values obtained were therefore omitted from the curves and tables.

*A summary of this paper was read by the senior author before the Ottawa meeting of the Royal Society of Canada.

(To be continued)

Industrial Chemical Club

The Industrial Chemical Club of the School of Practical Science, Toronto, has organized for the season, with the following officers: Honorary president, Dean Ellis; honorary vice-president, Prof. J. W. Bain; vice-president, W. P. Brodie. Third year representative, A. R. Clarry; chairman, C. W. Hancock; secretary-treasurer, H. C. Kerman; curator, J. C. Bell.

The Consumers Glass Company has been organized at Montreal. Frank P. Jones, vice-president and general manager of the Canada Cement Company, has been elected president, and Henry Jonas, vice-president. The directors are Arthur Lyman, J. A. Kirkpatrick and M. E. Williams. The new glass company is capitalized at $1,000,000. It has bought a factory building in Ville St. Pierre, a suburb of Montreal. It will start to work early in the new year, and will ultimately employ four or five hundred hands.

Donald C. McGregor, Dalhousie, has been appointed research assistant in the chemistry department, University of Manitoba, under the Advisory Council on Research.

Laboratories of Queen's University

Department of Chemistry

The Department of Chemistry at Queen's differs from that in many universities in the collection in one department of all the teaching and research in Chemistry for all the faculties of the University. Students in Arts, Science, and Medicine, all study in the same building. Students from the Dairy School are also included. The Chemistry building is a new, modern, stone structure, opened for occupancy in the autumn of 1911. Through the courtesy of Professor Baskerville, of the College of the City of New York, we were able to study the plans, construction, and equipment of the Chemistry building there; and, while the Queen's building follows these plans pretty closely, by somewhat reducing the size, and by cheaper construction and equipment, the cost was kept down to about one-sixth that of the magnificent New York building. In harmony with the Limestone City, Gordon Hall (named after Principal Gordon) is constructed of limestone quarried near the city. In this respect it is uniform with all the University buildings, the light grey rock-faced walls of which give one the impression of strength, coherence, and stability. The cost of the building was met by a grant from the Ontario Government,—a wise expenditure of public money,—more than justified by the practical importance of chemistry in developing the resources of the country. The exigencies of the Great War have awakened us rudely to the fact that Canada is very backward in this respect. But manufacturers, now that they see the point, are acting with characteristic energy. There is such a demand for young chemists, —for any chemists at all,—that it is impossible to meet it. Students who have not yet finished their course can easily secure good positions. "Women chemists not objected to" is a significant quotation from a letter recently received from a large Canadian manufacturing company. As most, if not all, manufacturers requiring the services of chemists make products used for war purposes or essential in some way in the prosecution of the war, it is quite obvious that the chemistry departments of the universities should be considered as Military Training Depots, quite as necessary as those in which men are prepared for military service at the front.

Chemistry Building, Queen's University, Kingston

Gordon Hall is a four storey building, 150 feet in length and 60 feet in width. The building is arranged on a logical plan, taking in the First Year students at the top, and working down until they reach the ground floor with the Third and Fourth Year Laboratories. By this means the large number of freshmen do not disturb the advanced workers by tramping around the corridors, and this also facilitates the systematic handling of the students.

The top or third floor consists of two laboratories for General Chemistry, one for Medical Chemistry, one for Electro-Analysis, a large Lecture Amphitheatre, 45′×36′, thoroughly equipped for demonstrations, and with a seating capacity of 216. Besides these there are two laboratories for Research work, a professor's room, a balance room, and a lecture preparation room. The fourth floor at present is used for storage purposes, but can at any time be converted into laboratories and class rooms.

The second floor consists of two laboratories for Quantitative Analysis, a balance room, a large laboratory, 45′×21′

for Organic Chemistry, a room for Food and Water Analysis, two rooms for Organic Combustion work, a departmental library, containing two thousand volumes, and equipped so as to be convenient for consultation and study, a store room and a large unoccupied laboratory, 36'×18'. Besides these, there are three professors' rooms, with private laboratories.

A double system of ventilation is provided, that for noxious

Experimental Reaction and Absorption Tower, with its fan, pump, circulating system and gas flues.

gases being entirely separate from the one for general ventilation. The laboratories are unusually well furnished with draught cupboards. Both high and low pressure steam is provided in the majority of the laboratories, and electricity for heating and motor purposes is available throughout the building. The building is equipped with an electrically operated elevator connecting all the floors. A special equipment, automatically operated, is provided for compressed air,—as well as a low pressure system for filtration work.

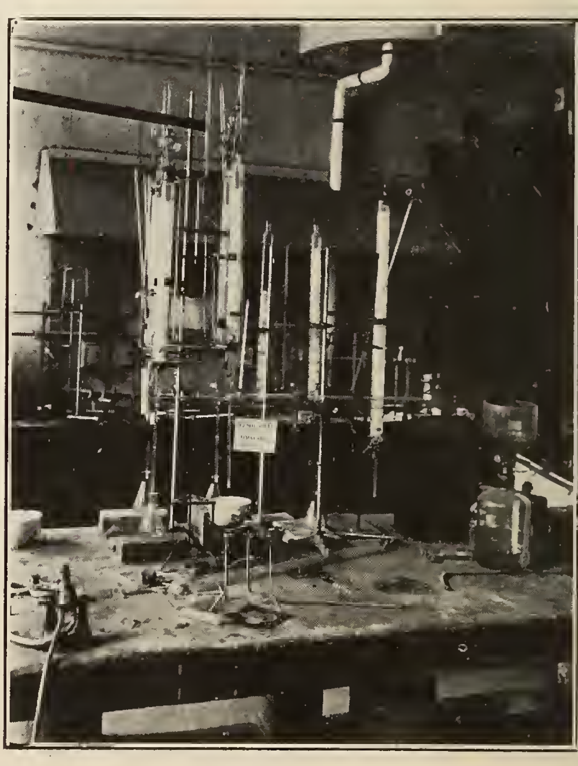
Having been built and equipped only recently the Chemistry Building at Queen's is modern in both respects. While constructed particularly for educational purposes, a considerable amount of space has been set aside for specialized work. Each professor has a small laboratory at his disposal for research. There are two laboratories available for post graduate students who may be carrying on investigations.

The first floor or basement consists of two large laboratories, 36'×18' for Qualitative Analysis, one large laboratory, 36'×21' for Fourth Year work and research work in Industrial Chemistry, and another laboratory 36'×18' for Third Year students in Industrial Chemistry. There are also, one room for Physical Chemistry, one for gas analysis, one for spectroscopy, one dark room for photography, a store room, and two small lecture rooms. Further, two small rooms which serve as professors' rooms and laboratories. The power room is also situated on this floor and will be described later.

The laboratories of Industrial Chemistry are equipped with selected types of apparatus on a semi-manufacturing scale, all selected to acquaint the student with different manufacturing operations. The size of the apparatus is so chosen that an experiment can be performed in a resonable amount of time, and the results fully worked out and studied. This is believed to be very much better than to try to work with quantities of a thousand gallons at a time, when a student may often work one or two weeks on mechanical operations, without any corresponding theoretical benefit. Among the apparatus installed are a Sweetland self-dumping filter press and tanks, a Bornett high-pressure acid proof filter, a small vacuum filter, a Sharples high-speed centrifuge, a small centrifuge for solids, various steam jacketed evaporating and dissolving kettles, both plain and porcelain-lined, and fitted with stirring gear. A large sized absorption and reaction tower, with selected types of filling material is connected to a fan and ventilating flues, and provided with a liquor circulating system for the study of the industrial absorption of gases. The special design of this tower with glass windows renders it particularly convenient for demonstrations. It is further planned to instal a large steam jacketed vacuum still and dephlegmating column to make students familiar with this very important method of industrial operation. The rest of the equipment follows conventional lines, with the exception of a large concrete table only two feet high, which facilitates the erection and handling of heavy apparatus.

Another feature which might be mentioned is a specially large sink, which allows large quantities of solutions to be rapidly cooled by immersing the containers in running water. There are also several ball mills, shaking apparatus, a variable speed motor and shafting, and a portable motor for general purposes.

The power room contains a large ventilating fan for the building, a small motor generator set giving 75 amperes at 15 volts, and connected to a small storage battery, the leads from whch are so



Corner of Research end of Industrial Laboratory, with glass apparatus for studying the conversion of nitric oxides in dilution with air, to nitric acid.

arranged as to supply current at either 4, 8, or 15 volts to the various laboratories. A brief description of the compressed air system may be of interest. This was designed after careful study, and consists of a Crowell rotary air compressor, coupled direct by means of a Kelly transmission to an electrometer. The starting and stopping of the motor is automatic, the cut-out operating when a pressure of 10 pounds per square inch is reached,

while the motor again commences to operate at a pressure of 3 pounds per square inch. This latter pressure was deemed most suitable for working blast lamps and for general use. To obviate too continual starting and stopping of the motor, a large balance tank is provided, holding sufficient compressed air at a pressure of 10 pounds per square inch for all ordinary uses. A reducing valve converts this into a pressure of 3 pounds per square inch for use. To prevent any fouling of the mains, an oil separator is interposed. This system has given complete satisfaction for the last six years and contrary to the usual pump compressors employed, has never shown any signs of overheating.

A small Crowell rotary vacuum pump electric motor driven is installed in conjunction with a balance tank and a scrubbing system. Being only intended for large vacuum distillations, or a number of small ones carried out at the same time, it has not been made automatic, being thrown into use when required. It has been safeguarded by an arrangement of switches which prevents the starting of the electric motor, without first admitting cooling water to the vacuum pump. The power room contains the usual instrument boards and gauges.

Mention should be made of the pipe and plumbing system in use. All plumbing is open, the pipes for each laboratory being carried on the floor below near the top of the underneath laboratory. In this manner all leaks are instantly accessible, without necessitating the tearing down of walls and conduits, which has been the source of frequent trouble in other laboratories. Main valves are provided on each floor for all services, and smaller valves are placed in each laboratory, so that shutting down one valve for repairs in no way affects the working of the other laboratories in the building. Electric outs for electrolysis or small motors are placed in each laboratory, and there is a complete set of electric outs in the Physical, Electro-chemistry and Electrolytic rooms. Each laboratory contains at least one high pressure steam plate for evaporations, which has been specially designed.

The distilled water supply has also been split up to obviate the general inconvenience caused by the breakdown of a large still. Brown stills manufactured in London, either steam heated, or combined with drying ovens, are installed in each laboratory. They are connected to 40 litre storage tanks, and thus each laboratory has its own independent distilled water supply. In the large laboratories the stills are steam heated, and the smaller ones gas heated so as to be available for use in summer.

A description of the metallurgical department of Queen's University will appear in next issue.

The British Coal Tar Color Industry and Its Difficulties in Time of War.*

By C. M. Whittaker, B.Sc.

(Concluded)

I now propose to pass on to the handicaps under which the British coal-tar color industry has been and is laboring.

The Achilles heel of the British industry was the fact that it had been in the habit of buying many of its intermediate products from the Continent. The result was that at the outbreak of war chemists had to work to replace these intermediate products, and suitable plant had to be erected, which absorbed a large amount of energy without increasing the immediate output of color.

One of the greatest handicaps has been the shortage of chemists. On the outbreak of war I doubt if there were twenty British chemists who had had actual up-to-date experience in the manufacture of coal-tar colors on the commercial scale. Of these who had had experience, some had their energies diverted to the manufacture of explosives to the detriment of coal-tar color manufacture. It was an inevitable result of the close interrelation between high explosives and coal-tar colors. No complaint is made of the diversion of this energy, but it requires to be stated as one of the definite handicaps of the industry during war-time. There was no reservoir of trained chemists from which to draw, so that university trained men of good theoretical knowledge, but no practical experience, have had to be taken, and naturally some time must elapse before they become adapted to their new conditions. The outbreak of the war, bringing in its train, the enormous demand for supplies of high explosives on a scale hitherto not contemplated, illustrated how closely interrelated was the manufacture of coal-tar colors and high explosives.

As everybody is aware, the two high explosives most largely in use are picric acid (or trinitro-phenol) and trinitololuol. The latter requires similar apparatus to that which is used for making compounds like nitro-benzol, so essential in coal-tar color manufacture. The engineering trade has been so much occupied in connection with the supply of munitions that it has been difficult to get delivery of the plant for the necessary extensions. For the same reason there has been a shortage of the skilled fitters necessary for the erection of the plant and of men to erect the necessary buildings. In fact, the shortage of labor confronts one at every turn. The increases in the prices of copper and lead, which enter largely into the apparatus used in coal-tar color manufacture, have also added enormously to the cost of such plant.

The life-blood of the coal-tar industry is sulphuric acid, fuming sulphuric acid and nitric acid. It is the misfortune of color manufacture that it is impossible to make any color without the use of nitric and sulphuric acids, the latter being required in various strengths of fuming acid from 70 per cent. down to 20 per cent. SO_3 and D.O.V. These self-same acids are also indispensable for the manufacture of the two high explosives, lyddite and T.N.T. It is a matter which admits of no argument that the demand for acids for the manufacture of high explosives must take priority over their numerous industrial uses. In that fact you have the greatest handicap of the Bri ish coal-tar color industry, because, as is well known by every acid consumer, the supply of acids is nothing like equal to the demand.

Amongst the raw or primary products of the coal-tar color industry the four most important are benzol, toluol, naphthalene and anthracene. The distribution of one of these products —viz., toluol—is controlled by the Government. The amount of toluol to be distilled from coal tar has very definite limits, which are relatively small, so that the reason for this control is obvious. Benzol is the starting-point for the manufacture of synthetic carbolic acid, of which so much is being made at the present time owing to the demand for outstripping the production of carbolic acid distilled from coal tar. This is being converted into picric acid. Benzol is also being used in large quantities for conversion into dinitrophenol, from which picric acid is also being manufactured.

Napthalene and anthracene are free markets. The control of one of the chief primary products is, however, a heavy initial handicap on the output of coal-tar products.

Alcohol Regulations

Attention is called to the official regulations regarding the manufacture of alcohol passed last August on the recommendation of the Food Consumption Control Committee, nominated by the Food Controller. By these it is provided that "No person shall use any wheat in the distillation or manufacture of alcohol unless such alcohol is to be used for manufacturing or munitions purposes, and no person shall use wheat in the distillation or manufacture of alcohol for manufacturing or munition purposes unless such person has obtained a license therefor from the Food Controller of Canada. No fee shall be payable for any such license."

Any offender against this regulation is liable to a penalty as high as $5,000.

Notes from New York

By F. M. Turner, Jr.

(Correspondence of THE CANADIAN CHEMICAL JOURNAL)

New York, December 20th, 1917.

Great interest has been taken in the case being tried at Baltimore, Md., consisting of suit to dissolve a temporary injunction compelling the Davison Chemical Company to supply the Baugh Chemical Company of Philadelphia, with almost one thousand tons of sulphuric a week until the expiration of a five year contract. The court ruled that the injunction be sustained, but modified the order by limiting its duration to December 31st next.

The Davison Company based their claim on the impossibility of their obtaining pyrites under present conditions at a price that would enable them to complete the contract without loss. They maintained that the original contract called for acid made from pyrites and that it could not be interpreted as compelling them to furnish acid made from brimstone, if pyrites became unobtainable through causes not under their control. The court decided, however, that the Davison Company had not exhausted all reasonable means for obtaining pyrites. They had not attempted to get domestic or Canadian pyrites, they had not tried to buy pyrites acid from other manufacturers to complete the contract, and the difficulty seemed to the court to be one chiefly of their unwillingness to pay the price and not caused by physical or political cutting off of their sources of supply. It is the intention of the Davison Chemical Company to take the case to the Court of Appeals of the State of Maryland. The case is interesting not only on account of the importance of the corporations involved, but because numerous manufacturers are likely to find themselves in similar difficulties owing to the transportation situation created by the war.

The Troco Nut Butter Company, a Milwaukee concern, is building a large plant for the hydrogenation of oils and the preparation of butter substitutes at Pawling, near New York. Great interest is being taken in such plants all over the United States at this time. The very high cost of butter, and the improvement in these substitutes—the best of them being acceptable to any palate—has made their manufacture a much more attractive proposition than it formerly was. In addition to this the recent decision of Judge Hand in the case between Proctor & Gamble, of Cincinnati, and the Berlin Mills Company, of Berlin, N.H., has cleared up the patent situation a great deal.

The United States Industrial Chemical Company has purchased the plant of the Curtis Bay Chemical Company, of Curtis Bay (near Baltimore), Md., and will convert the plant into an establishment for the manufacture of by-products of the alcohol industry. The company has $24,000,000 capital and Dr. M. C. Whittaker, formerly professor of Chemical Engineering in Columbia University, and former president of the Chemists' Club, of New York, is president. The engineering work connected with fitting the Curtis Bay plant for this new line of manufacture is now under way and is being done under the direction of the company's own engineers.

Salvarsan is to be manufactured in the United States and sold under the name of "Arsphenamine." Three firms have been licensed to manufacture this pharmaceutical, the patents on which are all held by Germans. The product will have to conform with rules laid down by the Federal Public Health Service, and a large part of it will probably be taken by the Government for the needs of the War Department. The firms undertaking its manufacture are, The Takamine Laboratories, Inc., of New York; Herman A. Metz, New York, and a Philadelphia firm whose name we do not know at present. Up to date this important drug has been manufactured only in Germany and in Toronto, Ont., by the Synthetic Drug Company. Since the war the price in the United States has advanced from the original high price of four dollars per dose to at least seven times that figure. It is expected that the American firms will be able to sell it at an even lower figure than that asked for the German article before the war. It is interesting to note in this connection that Dr. Simon Flexner, the director of the Rockefeller Institute recently announced that the medical experts at the Rockefeller had discovered a substitute for Salvarsan, much more efficient than that drug. Newspapers were quick to report that this new drug would sell for a few cents a dose, but this is most unlikely. The Hygienic Laboratory of the Public Health Service has been doing research work on Salvarsan substitutes for some time and nothing in their work would indicate that any valuable substitute could be turned out for any such low price.

According to the Manufacturers' Record, of Baltimore, announcement is momentarily expected from Washington that the Government has authorized the immediate beginning of construction work on huge dams across the Tennessee River at Mussel Shoals preparatory to the establishment of an industry to manufacture nitrates, ammonia and war-time necessities, all of which will entail an expenditure of approximately $50,000,000. Engineering crews and a number of Government officials are already on the ground completing preliminary plans. A spur track six miles in length is being laid from Sheffield, Tenn., to the Mussel Shoals site.

In West Sheffield, where the Government $5,000,000 experimental nitrate and powder plants are being built, more than one thousand men are employed and the work of construction is being expedited. Several buildings are nearing completion, and quantities of machinery and building materials are being assembled.

Priestley, the discoverer of oxygen, spent the greater part of his life in Philadelphia, having been driven from his home in England by religious persecutions owing to the fact that he was a theologian as well as a scientist, a combination commoner in his day than in ours. Priestley's home can still be seen in Philadelphia, but few people even in Philadelphia know much about his life and works, and in consequence the American Chemical Society have started a plan to erect a suitable memorial and the committee has made the following recommendations: First, that a bust portrait of Joseph Priestley be secured; that this be retained by the American Chemical Society, but be deposited as a loan in the National Museum in Washington. Second, that a gold medal be awarded at intervals of probably more than one year for superior achievement in chemical research, the award to carry with it the requirement that the recipient shall deliver an address before the general meeting of the society at the time of the presentation or at such other time and place as the council of the society may direct. The fund now has over $2,000 subscribed, and general support is expected especially from Philadelphia. It is interesting to note that Philadelphia possessed the first Chemical Society in the world, of which Priestley was a member and to which Robert Hare and other men who have done much for chemistry belonged.

War time activities are going to make necessary an increase in sulphuric acid production of 1,500,000 tons during 1918 The War Industries Board, the War Minerals Committee, the Department of Agriculture, the War Trade Board, the Department of Commerce, the National Research Council through its committees on Chemicals and on Fertilizers are all co-operating in an effort to solve this situation. Mr. M. F. Chase, of the Commercial Acid Company, St. Louis, Mo., has been attached to the War Industries Board as a specialist in sulphuric acid to take charge of this work. It is expected that the supply of acid to certain industries not necessary to war activities will be curtailed and that ships will be provided to ensure a plentiful supply of Spanish pyrites and that processes will be worked out tending to better utilization of domestic sources of pyrites and sulphur.

The Brooklyn Union Gas Company, in co-operation with the

Government, is going to make toluol at each of its plants. The standard of the company's gas is going to be changed from a candle power standard to a B.T.U. standard in order to make this toluol production possible. The toluol will amount to about 800,000 gallons per annum and will be used for making trinitrotoluol.

A most interesting meeting was held at the Chemists' Club on the evening of Friday, December 7th by the New York Sections of the American Chemical Society, the American Electrochemical Society and the Society of Chemical Industry. The subject for consideration was "Raiment" and the meeting was the second one of a series on national wastes that can be prevented by the application of chemistry. Dr. Allen Rogers, of the Pratt Institute, Brooklyn, read a paper on leather in which descriptions were given of a great many new ways to tan leather so as to use hides and skins that were formerly thrown away or used to make cyanides or fertilizers. He showed how sharks, eels, dog-fish and other animals could be tanned. He also showed how waste leather was worked up into leather board, and showed some new materials made from leather scrap spun into yarn and then woven, making a strong and beautiful fabric suitable for upholstery, etc.

The new leather substitute soles for shoes were also described, and after the address considerable debate ensued as to the relative merits of these soles and leather. It seemed to be pretty generally agreed that these soles were at least as good, if not better than leather, and that in view of the need of leather for other purposes in the army and navy their use should be encouraged. Dr. Rogers also dealt with artificial leathers, showing some interesting specimens of both American and British manufacture made by various processes.

The second address was by Dr. J. Merritt Matthews, the well-known textile expert. Dr. Matthews showed that much of the prejudice against shoddy is illogical because much of the shoddy manufactured in this country is better than much of the new wool. Shoddy made from good wool which has not been too much felted in the original weave, is as good as inferior grades of new wool, if not better, according to the speaker. Insistence on goods being "all wool" was also criticized, since goods in which wool and cotton are properly mixed are much more generally satisfactory, cost less and free wool for other uses. The use of paper for textiles was also touched on. Paper is now cut into narrow strips and these strips twisted so as to give yarn. The yarn is then woven together with some wool or cotton and the resulting fabric is strong, durable and of attractive appearance. These processes have been brought to a high point of development in Germany, in spite of the Hun's contempt for "scraps of paper," and Dr. Matthews had some specimen goods made in that way to show to the meeting. He concluded his address with a reading of the clothing regulations now in force in Germany, which are very amusing in their detailed supervision of the clothing of each and every individual. The number and quality and size of every garment every individual can possess are clearly stated and dire penalties threatened for breaking these rules.

Mr. Pearson and Mr. Sundermann, of the Cravanette Company, gave interesting facts about the various methods in use for waterproofing fabrics. Very great advances are being made in this line, and fabrics are now possible in which the waterproofing does not injure the appearance or other qualities of the cloth at all.

The attractiveness of the Chemists' Club has recently been greatly increased by a number of beautiful pictures provided through the kindness of Messrs. Robinson, Duggan, Kriegsheim and others. These pictures, together with the ones by Dr. Toch, which have adorned the walls for some time, make the Club one of the most attractively decorated places of the kind in New York.

More Words of Good Will

From Friends of The Canadian Chemical Journal

Permit me to congratulate you upon the excellent character of the JOURNAL, at least of the one number I have seen.—STEWART J. LLOYD, Professor of Chemistry, University of Alabama.

I am sure there is need for this magazine in Canada, and I am much pleased with the contents of the numbers received. —L. C. HARLOW, Professor of Chemistry, Agricultural College, Truro, N.S.

I think THE CANADIAN CHEMICAL JOURNAL is a mighty good thing and I am strong for making it pro-Canadian.—L. E. WESTMAN, Assistant Chemist, Department of Inland Revenue.

I consider this JOURNAL ought to fill a long felt want in Canada and I am enclosing cheque for $2.00 subscription.—FRED. BARNES, Chief Chemist, Belgo-Canadian Pulp & Paper Company.

I did not think, at first, there was much scope for a new JOURNAL, but now believe your publication will fill a need, and more particularly give Canadian Chemical manufacturers a JOURNAL in which to advertise.—L. F. GOODWIN, Professor Industrial Chemistry, Queen's University, Kingston.

I was very pleased with the sample copy of THE CANADIAN CHEMICAL JOURNAL and find it full of information even to a student in chemical engineering. Please enroll me as a subscriber for one year commencing October.—CLIFTON D. PHILLIPS, Clavet, Sask.

I must congratulate you on the success of THE CANADIAN CHEMICAL JOURNAL. I hope to see THE JOURNAL progress along its present lines in which special prominence is given to the kind of chemical industry which is likely to develop in Canada.—R. F. RUTTAN, Director, Department of Chemistry, McGill University.

The December number of your paper has come to hand and as a Canadian and chemist allow me to express my appreciation of your efforts in giving to Canadian chemists and to the chemical industry in Canada and throughout the world THE CANADIAN CHEMICAL JOURNAL. It is fully time that the rapidly growing chemical activities in Canada have a means of expression of their own.—A. F. G. CADENHEAD, Works Chemist, Canadian Electro Products Company, Shawinigan Falls, Que.

I have read the JOURNAL with much interest. The November and December numbers, in my opinion, are especially good. I hope that the JOURNAL may have a long and prosperous career, and that it will serve materially to aid in the building up of a strong chemical industry in the Dominion.—FRANK D. ADAMS, Dean of Faculty of Applied Science, McGill University.

Alcohol and Glycerin

The "Drogenhandler" stated on March 22nd that the sodium-sulphite lye from wood-pulp yields alcohol, and that the German Government is looking after the matter. A dozen or more factories similar to the one at Konigsberg, at which the discovery was made, are to be established in different places.

Two glycerin substitutes for dermatological purposes are announced in the "Chemiker Zeitung," perglycerin and perkaglycerin. They are described as similar to glycerin in composition, and practically the same from a physical point of view, though without any sweet taste; colorless, perfectly neutral, and antispetic. Perkaglycerin is preferred, being the more oily of the two and having stronger powers of water-attraction.

Harry Bayne, of Hamilton, has been appointed by the Department of Trade and Commerce as supervisor of metals and fibres. His business is to ensure to Canadian industries a sufficient supply of these raw materials at a reasonable price. Mr. Bayne was for many years connected with the Westinghouse Company and the National Car Company.

Foreign Trade Enquiries

The names and addresses of the firms making these inquiries can be obtained only by those especially interested in the respective commodities upon application to "The Inquiries Branch, The Department of Trade and Commerce, Ottawa." In writing correspondents should quote the number of the enquiry. The initials, "B.T.C." indicate that the enquiry for the address should be directed to the British Trade Commissioner in Canada, 363 Beaver Hall Square, Montreal.

903. A London company dealing in brass, cobalt, nickel, steel, hacksaw blades and press studs is prepared to purchase their supplies from Canada and in this connection to appoint a resident firm as buying agents upon a commission basis.

913. A firm of druggists in British Guiana inquires for soaps and perfumes.

922. A firm of chemical merchants at Manchester wishes to get into touch with Canadian manufacturers and exporters of oxide of nickel and cobalt, and molybdic acid.

1473. A London company asks to be placed in touch with Canadian producers of acetate of cobalt and of manganese.

1475. A Midlands company asks to be placed in communication with Canadian producers of raw potash feldspar.

1486. A London firm would be glad to hear from Canadian producers of sulphite-lye, a by-product of the pulp industry. Full particulars obtainable at Commercial Intelligence Branch, Department of Trade and Commerce, Ottawa.

1488. A Lancashire firm ask for names of Canadian manufacturers of acetate of soda.

1495. London firm ask for quotations c.i.f. Bilbao, Spain, or Genoa, Italy, for 100 tons and 1,000 tons of strong, easy bleaching and bleached sulphite (wood) pulp.

An English firm, owning a new process for the manufacture of acetic acid by wood distillation, desires to get into touch with Canadian firms who are considering the erection of new plant, or the extension or modification of their existing installations. B.T.C.

A London firm, manufacturing surgical instruments and drugists' sundries, wishes to appoint agents in the various provinces of Canada. B.T.C.

1511. A firm of merchants and representatives in Italy, with head offices in Genoa, and branches in Milan and Naples, would welcome Canadian agencies in metals and machinery, etc., such as agricultural machinery, pumps, railway supplies, machine tools, wrenches, pliers, diesel and semi-diesel twin motors, 100 to 400 horse power.

1516. A Plymouth firm wants to import arsenic 99½ per cent. pure; also sulphur. Arsenic is generally imported in casks of 3¼ to 4 cwts. (112 pounds to cwt.).

1518. A firm in Plymouth would be glad to hear from a Canadian exporter of phosphate rock.

1519. Canadian meat packers having bones and general residue for disposal are required to communicate with a Plymouth firm.

1520. A Plymouth firm desires to import iron ore.

1521. Ochre is wanted by a Plymouth firm.

1522. A Plymouth concern is prepared to import minerals of all kinds.

1556. A Durham, England, firm with long experience and established connections, are prepared to take up agency of lubricating oils.

1557. A London house company having a house in New York city wishes to secure supplies of tallow, palm oil, linseed oil, lubricating oil and fish oil.

Instead of shipping the copper matte to Tacoma, Wash., the proprietors of the smelter at Ladysmith, B.C., will install converters and other plant to cost over $1,000,000 for refining copper at their own works.

Laboratory Work of the Department of Mines

One of the chief functions of the Mines Branch of the Federal Department of Mines, Ottawa, is to undertake chemical, metallurgical, and mechanical investigations, with a view to assist the general mining industry of Canada.

To carry out this programme, it has been necessary, on account of the wide field of activity, to establish the following laboratories: Chemical, Fuel Testing, Ore Dressing and Metallurgical, Ceramic, Structural Materials, Highways, and Metallographic. Each laboratory is especially equipped and manned by a staff of efficient chemists and investigators.

While the department conducts investigations by its officers for department work, yet it desires to give all assistance possible to mining companies, miners and prospectors, when requests are received from them for help in connection with the solving of their various difficulties.

For identification of specimens and qualitative analysis of samples, no fee is charged, but, to protect the private assay laboratories, a charge is made for all quantitative determinations, particulars of which are given in a circular which may be obtained from the department on application. Those desiring to avail themselves of the facilities for investigation offered by the Department through her Laboratories should make application to Dr. Eugene Haanel, Director, Mines Branch, Department of Mines, Ottawa.

It may be interesting in this connection to refer to similar work as carried out by the Bureau of Mines of the United States. Director Van H. Manning, of that bureau, sends us the following statement:

The Bureau of Mines is not authorized so make analyses or assays for the sole benefit of private parties, its function being rather to investigate problems of general interest and importance to the mining industry, and to publish the results of these investigations for the benefit of the industry and the general public.

The bureau, however, desires to assist miners and prospectors in every way possible, and, if desired, will furnish a list of private chemists and assayers doing this kind of work. In supplying such a list, the bureau cannot, of course, undertake to recommend or favor any particular laboratory or individual, or tests made by these laboratories.

Attention is also directed to the fact that the Director of the Mint has announced that assays of ores for gold and silver at a charge of $1.00, and for copper, tin, zinc, iron, lead, and tungsten, at a charge of $1.00 for each metal determined in the sample, will be made at the mints at Philadelphia, Pa.; New Orleans, Ia.; and Carson City, Nev.; and at the minor assay offices at New York, N.Y.; Boise, Idaho; Helena, Mont.; Deadwood, S. Dak.; Seattle, Wash.; and Salt Lake City, Utah.

German Flotation Patents

Mr. Chapman who visited Cobalt in the interests of the Minerals Separation said that Germany was the only country in which his company had no patents. Commenting on this the Northern Miner says: "The reason is different from what Mr. Chapman infers. It seems that when application was made in Germany for patents by Minerals Separation, it was held that there was nothing new in the patents and that the process was fully covered by patents granted to the Ellmore brothers. This opens another side of the oil flotation controversy."

The disposition of these patents has been taken up by the Government, and while opportunity will be given to the Minerals Separation Corporation to make out their case the royalties will have to be paid over to Government, which will hold the proceeds in trust. Meantime it is thought that other companies will be allowed to use the process on reasonable terms.

Society of Chemical Industry

Canadian Section

From a review of the work of the Canadian Section of the Society of Chemical Industry, just issued, the following extracts are made:—

The Canadian Section of the Society of Chemical Industry has published under various titles in pamphlet form, collections of papers which have been read at meetings held during the sessions of the Section. Since much valuable information has been presented in this way, the Publication Committee of the Society of Chemical Industry has been pleased to sanction these publications.

In the present issue will be found an address delivered by the chairman of the Canadian Section giving a review of the progress of chemical industries since the outbreak of the war and outlining various lines of new endeavor that have been suggested by the necessities of the situation. Reference is also made to a plan for the consideration of methods of analysis with a view toward the adoption of standard methods sanctioned and recommended by the Canadian Section. A committee for the purpose was named during the year, and it is expected that valuable results will be secured through its activities. A paper has also been devoted to the production and use of oleomargarine with especial reference to the bearing of this material upon the food situation in Canada during and after the war. Other papers of timely interest are also included.

Should it be found desirable to pursue further any subject which has been dealt with in these issues, information may be sought in the Journal of the Society, which is supplied free to members.

The Society of Chemical Industry was founded in England in 1881, receiving a Royal Charter from the Crown in 1907, and numbers over 4,200 members. Its chief object is the promotion of those industries in which chemistry plays a part, be it large or small, and consequently manufacturers, engineers and chemists fill its ranks. The Journal which is published fortnightly in London, is the most important periodical on applied chemistry and chemical engineering in the world, and is widely recognized as an invaluable aid to all those whose occupation demands some chemical knowledge. It contains reports *in extenso* or in abstract form of the papers read before general and sectional meetings, with discussions thereupon; also abstracts of all British, Continental and United States patents on chemical and chemical engineering subjects; classified lists of British applications for patents and "Complete Specifications Accepted"; abstracts of articles relating to applied chemistry selected from British and foreign technical journals and transactions of learned societies; and a classified Trade Report, giving information on the Board of Trade returns, statistics, alterations in tariffs, Customs regulations, laws affecting chemical industries, consular reports, new openings for trade and new books. The following divisions, under which the abstracts are arranged, serve to show what industries are represented in the Society:

1. General plant; machinery. 2a. Fuel; gas; mineral oils and waxes. 2b. Destructive distillation; heating; lighting. 3. Tar and tar products. 4. Coloring matters and dyes. 5. Fibres; textiles; cellulose; paper. 6. Bleaching; dyeing; printing; finishing. 7. Acids; alkalies; salts; non-metallic elements. 8. Glass; ceramics. 9. Building materials. 10. Metals; metallurgy, including electro-metallurgy. 11. Electro-chemistry. 12. Fats; oils; waxes. 13. Paints; pigments; varnishes; resins. 14. India-rubber; gutta-percha. 15. Leather; bone; horn; glue. 16. Soils; fertilizers. 17. Sugars; starches; gums. 18. Fermentation industries. 19a. Foods. 19b. Water purification; sanitation. 20. Organic products; medicinal substances; essential oils. 21. Photographic materials and processes. 22. Explosives; matches. 23. Analysis. 24. Miscellaneous abstracts.

The Society of Chemical Industry is interested in almost every branch of manufacturing. It is a matter of everyday remark that chemistry is becoming more and more important in the industrial world, and this Society endeavors to furnish a common meeting ground for the manufacturer, the engineer and the chemist. Many of the papers which appear in its journal are quite readily followed and understood by those who have had no technical training, and no progressive Canadian who is interested in industrial affairs should lose an opportunity of keeping in touch with progress abroad as well as at home.

The Canadian Section extends to all who may be interested an invitation to be present at its meetings, the dates of which may be obtained from the secretary.

The chairman and the members of the Canadian Section wish to express their indebetedness to the Ontario Government for a grant toward the expense of publishing this work.

Officers for 1916-17:

Chairman—Theo. H. Wardleworth, Montreal.

Vice-chairmen—W. L. Goodwin, LL.D., Kingstor; N. N. Evans, Montreal; S. B. Chadsey, B.A.Sc., Toronto.

Committee—D. G. Buchanan, W. H. Thom, E. S. Pincott, Robt. Job, L. T. Acton, J. W. Bain, W. O. Walker, R. W. Perry, C. R. Hazen, H. Van Der Linde, J. S. Bates.

Canadian vice-president—R. F. Ruttan, M.D.

Honorary treasurer—E. G. R. Ardagh, B.A.Sc.

Honorary secretary—Alfred Burton, 114 Bedford Road, Toronto.

Hon. Resident Secretary for Montreal—F. A. Robertson, 36 St. Gabriel Street.

Hon. Resident Secretary for Ottawa—Jos. Race, F.I.C.

New Pacific Section

After nearly a year of preliminary work, the organizing committee are glad to report that the Society of Chemical Industry have now approved the formation of a local Section for British Columbia, to be known as the Canadian Pacific Section.

At the time the movement was started, there were eleven members of the Society in British Columbia and Alberta, and twenty-seven have since been added, so that the Section now comprises thirty-eight members, and further applications for membership are being received.

The following officers have been elected:

Chairman, J. A. Dawson, B.A.; vice-chairman, C. J. Berkeley; honorary secretary, J. H. Hamilton, office, 707 Yorkshire Building, Vancouver, B.C.

Committee—S. Barwick, R. H. Clark, M.A., Ph.D.; G. S. Eldridge, B.Sc.; H. J. Gardiner, J. Keillor; F. Moore, B.Sc.

On November 28th, the inaugural meeting of the Section was held at the University Club, Vancouver, there being an attendance of thirty-six.

Dr. F. F. Wesbrook, president of the University of British Columbia, addressed the meeting on the subject, "Science and the War," covering in detail the inter-relationship of the various branches of science and showing how the knowledge of scientific facts was being developed and utilized not only in furthering the art of warfare, but also in developing sanitation, surgery, medicine, engineering and the arts. He also dealt at some length with the necessity for the co-ordination of the educative systems of the Empire, if we are to derive the fullest benefits from the lessons of the war, and strongly advocated an Imperial Educational Conference, to be held at London to discuss these questions.

The meeting was also shortly addressed by R. F. Hayward, representing the Canadian Society of Civil Engineers; J. A. Cunningham, president of the Manufacturers' Association of British Columbia; C. F. Law, representing the Vancouver Board of Trade and Dr. S. D. Scott, president of the Vancouver Institute.

Organizing in Manitoba

A meeting of chemists interested in the organization of a Chemical Society in Manitoba was held on Tuesday, November 20th in the Science Building of the University of Manitoba, Winnipeg. Seventeen chemists were present. The meeting formed itself into a committee for purposes of organization and Professor M. A. Parker, of the Chemistry Department of the University of Manitoba, was chosen chairman. Dr. A. McGill, of the Inland Revenue Department at Ottawa, briefly addressed the meeting.

After discussion, the following committee was appointed to draft proposals for permanent organization to be submitted to a future meeting: Professor M. A. Parker, Professor J. W. Shipley, Dr. H. S. Davis, Mr. N. H. Blackie.

Toronto Section

A meeting of the Toronto Section of the Society of Chemical Industry will be held on the 21st December. A paper by E. P. Mathewson, on the "History and Development of Nickel" will be the feature of the evening.

Prof. J. W. Bain, of the University of Toronto, has given notice that at this meeting he will move that the method of water analysis applied by Mr. Race for the City of Ottawa—reported in this issue—be made the standard for the Society.

At a later meeting of this Section, Dr. Boswell, of the University of Toronto, will present a paper on "Chemistry in Agriculture."

Quicksilver

The embargo put upon the export of quicksilver in Great Britain will stimulate interest in the mercury of Canada There has been no production of quicksilver in Canada since 1897, when small quantities were derived from the deposits near Kamloops, B.C. There are also deposits in Vancouver Island and in the Cobalt region, but neither these nor the scattered deposits of low grade ore in the United States have been worked. We note that the New Zealand Government has offered a bonus of eight cents per pound for the first 100,000 pounds of retorted quicksilver produced in that Dominion under the condition that at least one-half of the quantity is produced by March 31st, 1920, and the remaining half before March, 1921.

Destructive Explosion in Halifax

On the morning of December 6th a Belgian relief ship the Imo, collided with a munitions ship, the Mont Blanc, in Bedford Basin, Halifax, N.S. The side of the Mont Blanc was penetrated amidships, starting a fire which resulted in an explosion. the most terrific recorded in the history of warfare. The explosion caused a tidal wave which struck a ship thirty-five miles at sea, smashing the pilot house and damaging its upper works, and one hundred miles from the harbor another ship was severely affected.

The tidal wave, added to the force of the air blast of the explosion, threw a train of cars a hundred feet or more from the tracks of the Intercolonial Railway. Individual cars were blown three hundred yards from thier track North and west of the I.C.R. station the buildings in an area of a mile by nearly two miles in extent were leveled; while a portion of the town of Dartmouth on the opposite side of the basin was destroyed. In the rest of Halifax, a city of about fifty thousand, the windows of almost every house were shattered.

The loss of life is variously estimated at 1,200 to 2,000, nearly all civilians. Among the hundreds of others who were injured, two to three hundred were blinded by bits of glass and fragments blown into the houses when people came to the windows upon feeling the first quaking of the earth. It is estimated that five hundred houses were demolished and another five hundred rendered uninhabitable. The buildings damaged or destroyed included several factories, the railway station and wharves, the total property damage being estimated by some at $20,000,000. On land the shock of the explosion was felt at New Glasgow, one hundred miles distant and a slight shock was felt at Charlottetown, P.E.I., two hundred miles distant by sea, or about one hundred miles across the land. Windows were broken in Truro 62 miles distant.

The munitions ship was bound from New York for overseas. and her cargo is unknown here, but the quantity of explosives on board was reported at 2,800 tons, consisting of T.N.T. and picric acid, with a deck load of benzine. The picric acid was stored in the forward hold with the benzine above it, and the T.N.T. in the middle and after holds. Reports as to the cause of the collision are conflicting, but statements have been made that both ships were on the wrong side when passing through the Narrows.

Enquiry into the disaster is now proceeding.

Destruction of German Chemical Works

It is remarkable that within a few days of the blowing up of the munitions ship at Halifax, N.S., reports should come of the destruction of the great chemical works of the Griesheim Company at Frankfort-on-the-Main, Germany. The explosion took place November 22nd, but the news was suppressed by the German newspaper for some days.

The cabled reports give the following account of the fatality which must have brought sudden death to numbers of highly skilled chemists as well as to skilled workmen, the workers being completely destroyed.

The Griesheim factory consisted of a group of buildings covering over fifty-four acres. Before the war it ranked fourth in importance among the great chemical works, and was flourishing, the company paying a pre-war dividend of 14 per cent. and being worth as a going concern well over 60,000,000 marks.

Its commanding position rested not only on its huge total output but on the extensive variety of its chemical products. These comprised, among other things, aniline dyes of every description, nitric, sulphuric, and other acids, phosphorus, and alkali, with liquid chlorine, hydrogen, and oxygen as important by-products. It was of prime importance as a source of synthetic nitrates, and its splendidly organized research laboratory enabled it to play a leading part in the production of poison gas which Germany introduced in the course of the war.

The Griesheim concern has been producing saltpetre for the manufacture of black powder at the rate of 1,000 tons daily, and it was reputed to be the only factory turning out this article. To such an extent had its already impressive output of soda nitrate and concentrated sulphuric acid been developed that it supplied the whole demand of five nitro-glycerine and dynamite factories, as well as of two powder works, including that of Rottwell, one of the most important in Germany.

Another explosive which was manufactured in large quantities was tonite, through its facilities for making synthetic phenol, and consequently picric acid, from which acid this explosive is derived.

This factory supplied quantities of electrolytic hydrogen for the inflation of Zeppelins, and had a reserve supply of over 300,000 cubic feet of this gas. The electrolytic plant was further utilized to produce asphyxiating gas and lachrymatory and poisonous shells. In fact, it was the greatest centre of this manufacture in Germany, and in 1916 the output of poison gases reached nearly 600,000 cubic feet daily.

Every concern in Germany is affected both by the cutting off of supplies which many of them formerly drew from Gresheim, and by the necessity of making the loss of these supplies good from plants already working to the maximum.

Industrial News Items

An $800,000 sugar plant may be erected at Leamington, Ont.

A plant for the manufacture of acetone is talked of in British Columbia.

T. B. Wakefield, of Oakland, Cal., is interested in the proposed chemical works at Vancouver.

The Wasapika Gold Mines, Limited, will erect a cyanide mill. Manager, G. R. Rogers.

The new four-story building for the Prestolite Company, on Centre Avenue, is completed and occupied.

The Exolon Company, manufacturers of abrasives at Thorold are enlarging their plant at a cost of nearly $100,000.

The Canada Metal Company, Limited, of Toronto, have leased a plant in Vancouver for making Babbitt metal.

The Sabulite, Limited, of Coquitlam, B.C., will operate a plant in False Creek, Vancouver, to make desiccated vegetables.

Construction on the works of the new Brunner-Mond of Canada, Limited, plant, near Amherstburg, is being rushed to completion.

The plant of the Hastings, Ont., Tanning Company, owned by the Breithaupt Company, of Kitchener, was completely destroyed by fire. Loss, $200,000.

In the report of the Coniagas Mines in last issue the amount provided for development during the coming year should have been $150,000.

The Granby Consolidated Mining, Smelting and Power Company, of Vancouver, will erect a $1,500,000 coke oven plant at Anyox, B.C.

The Canadian Copper Company will build a $2,000,000 oil flotation mill at Penticton to be finished in a year. The assured ore measures 10,000,000 tons.

The pulp and drying buildings of the Dominion Sugar Company at Wallace burg, Ont., were destroyed on the night of December 10th, the loss being estimated at $100,000.

A unit of the ether recovery department of the British Chemical Company, Trenton, Ont., was destroyed on the 30th November, four lives being lost in the explosion.

The Cluff Ammunition Company, Atlantic Avenue, Toronto, whose building was destroyed by fire recently, are rebuilding. Estimated cost, $200,000.

Vancouver, B.C.—The Pacific White Lead Company, of Montreal, will establish a lead and paint industry on Industrial Island. Some $50,000 will be spent on the construction of buildings.

The Miller-Independence Mine at Boston Creek, North Ontario, is the first gold mine in Ontario to adopt the oil flotation process. It is claimed that over 90 per cent. of the gold is recovered.

The Chemical Products of Canada, Limited, Toronto, will start making permanganate of potash and will be producing shortly. T. E. O'Reilly, Excelsior Life Building, Toronto, is selling agent.

The International Feldspar Company, of Ottawa, are operating a feldspar quarry north of Kingston and are shipping their rock to the United States for use in the ceramics industry with potash as a by-product.

The miners and smelters at Trail, B.C., went out on strike on November 15th for an eight hour day, regardless of an agreement until after the war. Nearly all the mines in the district are closed. An early settlement is expected.

The Pacific Coast Kelp Company propose to take up the plant of the Canadian Potash and Algin Company, at Sidney, Vancouver Island. Another potash plant has been installed at Moresby Island, one of the Queen Charlotte group. It will use kelp and will extract oils from non-edible fish.

The net earnings of the Sherwin-Williams Company of Canada, paint and color manufacturers, were $945,273 for the past year, or $100,000 over those of 1916. Mr. Cottingham, the president, reports that the new branch works at Sydney, Australia, are now completed and have begun business with a promising outlook.

The name of the Geigy-ter Meer Company has been changed to the Geigy Company, Inc. This company whose works and headquarters are in Basle, Switzerland, are represented in Canada by T. D. Wardlaw, Toronto. Mr. Wardlaw informs us that the standard dyes of the Geigy Company are coming direct from Switzerland to Toronto. Four shipments are on the way and regular shipments will follow.

The stock of the Algoma Steel Corporation, Sault Ste. Marie, Ont., will be surrendered to the Lake Superior Corporation on March 1, 1918. The Algoma Steel Corporation will erect six Gunite buildings to operate the Cement Gun method. W. C. Frantz will succeed J. Frater Taylor, as president of this corporation. Mr. Taylor, who is retiring at the end of the year will act as chairman of the Lake Superior Corporation. The steel company will install 25 by-product coke ovens, work on which will be started at once and finished next summer.

Owing to the shortage of iron and steel for munitions and shipbuilding an order-in-council has been made public prohibiting the export to countries other than Great Britain and her possessions of the following articles: Pig iron, steel ingots, billets, blooms, bars and slabs, iron and steel plates and shapes, beams, channels, angles, tees and zees, castor oil, glucose, soap, glycerine, grease, linseed oil, fertilizers, stearine and stearine acid. Also all chemicals, dyestuffs, and tanning materials to the Netherlands and the Scandinavian countries. The prohibition applies to most oils, including oleomargarine, starch, sugar and condensed milk.

The members of the Toronto Section of the American Institute of Electrical Engineers, recently made a trip around the harbor inspecting the works on the water front. The visitors were much interested in the industrial development around Ashbridge's Bay. Most notable among these factories is the British Forgings plant which extends from Cherry Street East to the Don roadway. Side by side with this, the world's greatest electric steel plant, it is hoped the near future may see the erection of a steel plate and sheet mill sufficient at least to take care of Canada's growing shipbuilding industry. Ships are being constructed along the eastern shore, the four hundred feet ship channel with its turning basin at the foot of Carlaw Avenue is visibly taking shape and the concrete marginal ways and streets nearing completion.

The Harris Abattoir Company, Limited, and the Swift-Canadian Company, Limited, both of Toronto, have been granted a license to manufacture oleomargarine in Canada.

The Dominion Steel Products Company, of Brantford, Ont., and New York, referred to last month, are reorganizing the works at Holmdale, Brantford, and will make 5-inch naval guns and propellor shafts for use on United States vessels. W. F. Kellert is president and general manager; D. O. Johnson, treasurer, and M. F. McGraw, secretary. W. D. Powell is chemist and metallurgist.

The United Rubber Manufacturing and Reclaiming Company, of Toronto, are building a factory to cost $50,000 at Whitby, Ont., and expects to be in operation in the spring.

Coming Events

The annual meeting of the Canadian Society of Civil Engineers will be held at 176 Mansfield Street, Montreal, January 21st, 22nd and 23rd.

The annual convention of the Canadian National Clay Products Association will be held at the Prince George Hotel, Toronto, January 29th, 30th and 31st, 1918.

Announcements regarding meetings of the Society of Chemical Industry will be found on another page.

The annual meeting of the Toronto Section of the American Institute of Electrical Engineers will take place in Toronto on April 6th.

Personals

Lieut. A. F. G. Cadenhead, B.A., of Queen's University, has been transferred from the 50th Field Battery to the Canadian Electro Products Company, Shawinigan Falls, Que., as works chemist.

O. J. B. Fraser, B.Sc., Queen's, 1916, has been transferred from the 50th Field Battery of the Canadian forces to the works of the International Nickel Company, New Jersey.

K. S. Clarke, B.Sc., is superintendent of the mill of the Mond Nickel Company, Coniston.

Dr. A. McGill, chief analyist of the Department of Inland Revenue, has accepted membership on the Food Controller's committee on cereals. The other members are: Prof. R. Harcourt, professor of chemistry in the Ontario Agricultural College, Guelph, chairman; W. S. Lecky, of the War Purchasing Commission; P. B. Tuslin, member of the Royal Sanitary Institute and chief of the Food and Dairy Division of the Health Department, Winnipeg.

J. Frater Taylor has resigned from the presidency of the Algoma Steel Corporation, but will remain with the company in an advisory capacity as chairman of the Lake Superior Corporation. W. C. Franz will succeed Mr. Taylor as president of the Algoma Steel Corporation.

At the works of the Deloro Smelting and Refining Company, Deloro, Ont., R. A. Elliot is general superintendent; C. H. Burkard is head of the oxide plant, with G. E. Bolton, assistant; H. A. McNally in charge of the silver plant; S. E. MacGregor, superintendent of the metals department, and H. C. Barlow, assistant to the chief chemist. All have the degree of B.Sc. of Queen's University.

Frank Wharton Brooke, formerly metallurgist of Crowleys, Detroit, and at the Ludlam Steel Works, and G. W. Ketter, who has just finished the installation of ten 6-ton furnaces at the British Forgings, Limited, Toronto, have joined the staff of the Electric Furnace Construction Company, at Philadelphia.

E. O. Ewing, of the staff of James, Loudon & Hertberg, Limited, has joined the University Officers' Training Corps.

A. Gordon Spence, formerly chief chemist of the Canadian Inspection and Testing Laboratories of Montreal, has severed his connection with that company and has opened an office at 617-8 Transportation Building, Montreal, as a consulting chemist and metallurgist.

Capt. George E. Tinling, of the 3rd East Lancashire Regiment, who was recently killed in action in France, was the son of Chas. W. Tinling, vice-president and general manager of the National Drug & Chemical Company, Montreal, and chairman of the Society of Chemical Industry in Canada. He was born in Hamilton. Another of Mr. Tinling's sons was killed in action some months ago.

F. D. Canfield, jr., a director of Canada Foundries and Forgings, Limited, and among the large shareholders of the company, died recently in New York.

Ambrose Monell, of New York, president of the International Nickel Company, has tendered his resignation to accept a commission as colonel on the staff of the commander of the American aviation forces abroad. It is not generally known that the name of Monel metal was given in honor of Mr. Monell.

Lieut. C. S. L. Hertzberg, M.C., a former member of the Canadian Engineers and adjutant of the Spadina Military Commission, was in command with the League of the Allies in New York in the work of organization. Lieut. Hertzberg is a member of the engineering firm of James, Loudon & Hertzberg, Toronto.

Among those graduated from the Officers' Training Camp at Plattsburg, N.Y., November 24th, was August Klipstein, jr., son of August Klipstein, president of A. Klipstein & Company, New York City and Montreal He has received a commission as first lieutenant in the infantry.

Dr. E. P. Wightman, research chemist of Parke, Davis & Company, of Detroit, Mich., and Windsor, Ont., has enlisted as a chemist in the gas and flame division of the 30th Engineers of the United States Army.

H. J. Fuller, president of the Canadian Fairbanks-Morse Company, Montreal, and Toronto, has been elected president of the E. and T. Fairbanks Company, of St. Johnsbury, Vt. Mr. Fuller came to Canada in 1897, after completing his studies at the Polytechnic Institute of Worcester, Mass. He is now the head of establishments employing several thousand hands.

The Welland Tribune reports that R. W. Knight, manager of the Standard Steel Company, at Port Robinson, Ont., has been appointed advisory engineer to the United States Government in France, and has safely arrived in France to take up his new duties.

H. J. Fuller, president of the Canadian Fairbanks-Morse Company, has been appointed to represent the Imperial Munitions Board in New York.

George H. Clarkson, B.A.Sc., of Toronto, is now superintendent of the Frodingham Iron and Steel Company, Lancashire, England. He served for a time on the Imperial Munitions Board in England.

Lieut.-Col. Lindsay Malcolm, professor at Queen's University, Kingston, will succeed Lieut.-Col. Irving, recently killed in action.

Walter C. Teagle, of Toronto, the new president of the Standard Oil Company, of New Jersey, although only thirty-nine years of age, is regarded as one of the best informed oil men on the continent. He was vice-president of the Republic Oil Company for three years, when he left to join the Standard Oil Company, who sent him abroad to study the oil industry in England, France, Germany and Roumania. Returning he was made vice-president of the Standard Oil Company, of New Jersey, in 1910, which he resigned after three years to become president of the Imperial Oil Company, of Toronto. He organized the International Petroleum Company, built a fleet of tank steamers and bought a number of Peruvian Oil companies. In three years he increased the annual capacity of the Imperial Oil Company's refineries from 2,000,000 to 6,500,000 barrels and another large refinery is nearly complete in Dartmouth, N.S.

Recent Incorporations

Kander Paper Stock Company, Limited, Montreal, $35,000.

Sunlock Mines, Limited, Vancouver, $1,000,000.

Underhill Coal and Coke Company, Limited, Toronto, $450,000.

Canadian Feeds and Fertilizers Company, Limited, Vancouver, $10,000.

Paudash Lake Molybdenite Mines, Limited, head office at Wilberforce, capital, $150,000.

The Battle Natural Gas Company, Limited, capital, $100,000. Head office, Hamilton.

The Bond Engineering Works, Limited, $100,000. Head office, Toronto.

The Crystal Products, Limited, Toronto, $300,000, to engage in general mining operations.

The Great West Chemical Corporation (non-personal liability), Port Arthur, Ont., $1,500,000. R. J. Allman, A. Plenty, S. A. Wilson.

Laval Chemical Company, Laval, Montreal, $100,000. C. E. Laurion, J. C. V. Roy, J. A. Guy.

Paudash Lake Molybdenite Maines, Wilberforce, Ont., (no personal liability), $150,000. M. A. Boyd, D. A. McCrimmon, G. A. Sullivan.

Eagle Smelting and Refining Works, $40,000. P. Bercovicth, E. Lafontaine, N. Gordon.

British Columbia Electro Metals, Vancouver, $100,000; Canadian Feeds & Fertilizers Company, Limited, $10,000.

Mid-West Oil Company, Calgary, $1,000,000.

Chemical and Metal Markets

The Quotations below represent average prices for the quantities indicated. Larger quantities may be obtained at lower figures.

TORONTO, December 20, 1917.

The growing scarcity of oils, both mineral and vegetable, is one of the noteworthy features of the past month. The difficulty of procuring oils in sufficient quantity affects the whole world and is due largely to rail and steamship troubles. This transportation problem in oils affects in turn all the manufacturers who use oils in their industries, such as the soap factories, paint manufacturers, etc. As to mineral oils the United States Government is taking steps to encourage new production by permitting prospecting work on public lands, and Canada ought to move on the same lines. The Roumanian oil fields under German control are now said to be producing nearly 2,500 tons per day, but as an offset to this in the world's output many thousands of tons have been destroyed at Baku and a strike further paralyses the Russian oil field.

The prohibition of the export of certain chemicals and raw materials, both by the Canadian and United States Governments has upset many a calculation in the chemical trade and tends to make manufacturers careful in entering into large contracts.

Bleaching powder is firm owing to large government orders; but caustic soda for some weeks has been becoming weaker owing to the export situation. Ammonia still rising owing to scarcity of supply.

Acetate of lime is strong and the output well taken up.

Nickel salts are steady in price, the New York prices being 13 to 16 cents.

There is a large volume of business doing in salt cake for the glass industry at $25.00 to $28.00 per ton.

There is an active demand for sulphate of zinc and prices have slightly advanced.

There is a short supply of most mineral acids and their raw materials, and this is marked in sulphuric, picric and nitric acid.

The regulation of prices of iron and steel by the American Government is the principal explanation of the lowering tendency of prices in Canada, and that action has had a steadying effect on other metals in Canada and the United States. The difficulty in procuring coke has restricted the output of some mills in Canada.

Inorganic Chemicals

Alum, lump ammonia	100 Lbs.	$5.50—6.00
Aluminium Sulphate, high grade, bags	100 Lbs.	3.00
Ammonium Carbonate	Lb.	.14
Aqua Ammonia .880	Lb.	.11
Bleaching Powder, 35% drums	100 Lbs.	3.50
Borax, crystals	Lb.	.09—.10
Boric Acid, powdered	Lb.	.17
Calcium Chloride, crystals fused	100 Lbs.	6.25
Caustic Soda, ground, Bbl	Lb.	.09—.10
China Clay, imported	per ton	$25—$30
Cobalt Oxide, black	Lb.	1.50—1.75
Copper Sulphate (Blue Vitriol)	Lb.	.11—.12
Fuller's Earth, powdered	100 Lbs.	6.00
Hydrochloric Acid, carboys, 18°	Lb.	.03—.03¾
Lead Acetate, white crystals	Lb.	.20
Lead Nitrate	Lb.	.18—.20
Magnesium Carbonate, B.P., brl	Lb.	.10—.12
Nitric Acid, 36° carboys	100 Lbs.	11.00
Phosphoric Acid, S.G. 1750	Lb.	.75
Potassium Bichromate	Lb.	.60
Potassium Bromide	Lb.	1.50—2.00
Potassium Carbonate 90 to 95%	Lb.	.85
Potassium Chlorate, crystals, Kegs	Lb.	.90
Potassium Nitrate......, Kegs	Lb.	.37
Potassium Permanganate, bulk	Lb.	4.00
Silver Nitrate	Oz.	.80—.85
Soda Ash bags	Lb.	.04½
Sodium Acetate	Lb.	.15—.20
Sodium Bicarbonate, 100% pure	100 Lbs.	3.75—4.00
Sodium Bichromate, bbls,	Lb.	.25
" " casks	Lb.	.23
Sodium Cyanide, bulk, 98-99 per cent, in cases	Lb.	$ .45
Sodium Hyposulphite, kegs	100 Lbs.	2.75
Sodium Nitrate, refined	100 Lbs.	8.00
Sodium Silicate, according to density	100 Lbs.	2.00—3.75
Sulphur, ground	100 Lbs.	4.50—5.00
Sulphur, roll	100 Lbs.	4.00—4.50
Sulphuric Acid, 66°Be, carboys	100 Lbs.	3.75
Tin Chloride, crystals	Lb.	.48—.49
Zinc Sulphate, com	Lb.	.6½

Organic Chemicals

Acetanilid, C.P	Lb.	80—.90
Acetic Acid, 80 per cent pure	Lb.	.25—.30
Acetic Acid, glacial, 99½% in carboys	Lb.	.45
Acetone	Lb.	.36—.43
Alcohol, methylated, .bbl	Gal.	1.60
Alcohol. grain, bbl	Gal.	6.50
Alcohol, wood, 95 per cent., refined	Gal.	1 .45—1.50
Aspirin (acetyl salicylic acid)	Lb.	4.50
Benzoic Acid	Lb.	3.25—4.00
Carbolic Acid, white crystals	Lb.	.80—.90
Carbon Bisulphide	Lb.	.10—.15
Chloroform, com	Lb.	.75—.90
Citric Acid, domestic, crystals	Lb.	.80—.90
Glycerine, 56 lb. tin	Lb.	.80
Oxalic Acid	Lb.	.55
Salicylic Acid	Lb.	1.25—1.50
Tannic Acid, commercial	Lb.	1.40—1.50
Tartaric Acid, crystals or powdered	Lb.	.80—.90

Metals

Aluminium	Lb.	.50—.60
Antimony	Lb.	.18—.19
Brass, yellow ingots	Lb.	.18—.20
" red	Lb.	.25
Cobalt	Lb.	2.25
Copper, casting	Lb.	.32
Copper, electrolytic	Lb.	.33
" Am. Government price (electrolytic and casting	Lb.	.23½
Iron, bars	Lb	.5¼—.06
Lead	Lb.	.08—.09
Magnesium	Lb.	2.50
Mercury	Lb.	1.50—2.00
Nickel	Lb.	.48
Platinum, pure	Oz.	105.00
Silver	Oz.	1.00
Spelter	Lb.	.07—.10
Steel, sheet	Lb.	.08—.12
Tin	Lb.	.66—.75
Zinc, sheet	Lb.	.25—.30

Index of Advertisements

Classified Index of Advertisements

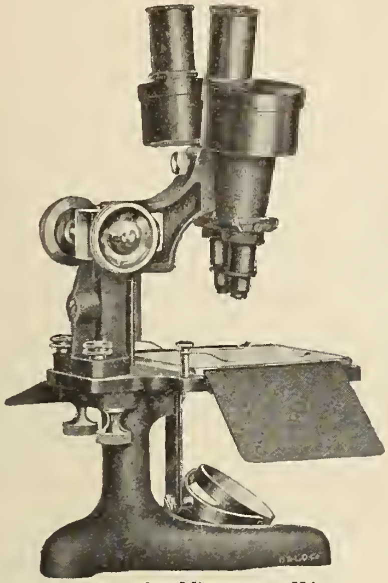
CANADIAN CHEMICAL JOURNAL

A Canadian Journal devoted to Metallurgy Electro-Chemistry and Industrial Chemistry.

Vol. II, No. 2 | TORONTO, FEBRUARY, 1918 | 20c. a copy; $2 a year

For Index of Advertisements
See Page 40

Classified Advertisements
Page 45



Binocular Microscope KA

THE TOPLEY COMPANY

Special Canadian Representatives

BAUSCH & LOMB OPTICAL CO.

The products of this well known firm are supplied by us in Canada under the most advantageous conditions. A large and well selected stock is carried on hand. Prompt, reliable and courteous attention is given to all inquiries.

In addition to OPTICAL INSTRUMENTS we can offer unexcelled service in supplying APPARATUS required for the complete equipment of the RESEARCH and INDUSTRIAL LABORATORY.

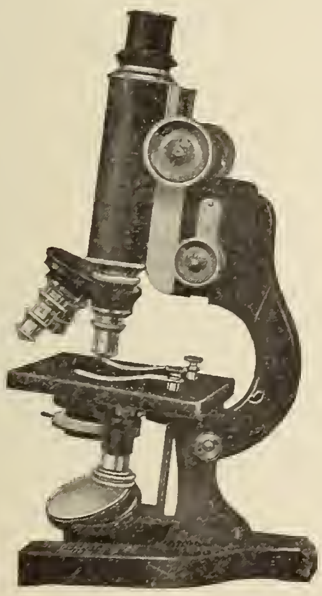
Catalogues, pamphlets and information cheerfully supplied concerning any of the lines we handle.

ENGINEERING AND OPTICAL INSTRUMENTS T

THE TOPLEY COMPANY

132 Sparks Street -- :- OTTAWA

Scientific Apparatus



The J. F. Hartz Co., Limited

Headquarters for Chemical and Scientific Apparatus

We carry a full line of

PYREX GLASSWARE, WHATMAN FILTER PAPER, COOR AND OHIO PORCELAIN, MICROSCOPES, ETC.

Write us for quotations on all Apparatus necessary for Chemical and Bacteriological Laboratories.

THE J. F. HARTZ CO., LIMITED

24-26 HAYTER STREET - - - - TORONTO, ONT.

PROFESSIONAL DIRECTORY

TALKS *with our* FRIENDS

THERE is a note of progress in the air. It is the springtime of the chemical era of Canada. One of the signs of this springtime is the enthusiastic way in which the chemists and their friends have taken up the proposal for the first general convention of the chemists of Canada, to be held in Ottawa. It was first proposed to hold it in April but May has been found to be a more convenient month, especially for those engaged in higher educational work. It will be fixed for the latter part of the month, and will probably coincide with the meeting of the Royal Society of Canada. Further notices will be found in our reading pages.

A Chance to Serve

We are still receiving calls for back numbers making up Vol. 1, 1917. We are out of the numbers for July, August, September, October, November and December: and as a number of calls for Vol. 1 come from universities, public libraries and other public institutions, we will appreciate the kindness of any reader who can send us copies of any of these numbers. If the reading contents are complete, full price will be paid for each copy or a subscriber will be credited with two months on current subscription for each copy received.

Increase in Vol. II

To provide for increases this year we added 300 copies to our January issue, but of these extra copies we have less than 100 now left. To secure this volume complete new subscribers should send in orders early.

The Helping Hand

The Journal has its shortcomings, but we gratefully acknowledge that these are not magnified by our new friends, who are helping it forward. Many good-will letters have been published already.

Prof. J. W. Shipley, Secretary of the Manitoba Chemical Society, writes:

"I am enclosing a report of our meeting. We appreciate very much your interest in our Society, and you may be sure that we will do whatever we can to further the progress of your journal."

Another esteemed subscriber, a prominent member of the new British Columbia Chemical Society, writes:

"I have already endeavoured to send you several subscribers, the Industrial Commissioner of Vancouver being among those responding."

A technical writer in a Lancashire city, offers his services as a contributor on matters chemical in England.

J. H. Stevens, Melbourne, Australia, writing Dec. 7th, on behalf of the Commonwealth (Government) analyst, says:

"We have pleasure in remitting one year's subscription, to be sent to the Commonwealth Analyst. The Analyst would be glad to have the complete file for 1917.

CANADIAN CHEMICAL JOURNAL

A Canadian Journal devoted to Metallurgy Electro-Chemistry and Industrial Chemistry.

Vol. 2 TORONTO, FEBRUARY, 1918 No. 2

CANADIAN CHEMICAL JOURNAL

DEVOTED TO THE CHEMICAL AND METALLURGICAL INTERESTS OF CANADA.

Published monthly by the Biggar Press Limited

Office, 36 Toronto St., Toronto, Canada

Telephone Main 7399. E. B. BIGGAR, Managing Director

Subscription price, $2.00 per year to Canada, United States and all parts of the British Empire.

Time of going to press, 25th of the month preceding date of issue. News and changes of advertisements should be in hand one week before.

NOTICE

The Editorial Department exercises every care to ensure the correctness of the contents of the Journal. It is understood that the authors of signed articles are alone responsible for the statements they may make, whether of fact or opinion. Address all editorial correspondence to 36 Toronto Street.

Principal Contents

Back numbers of the Canadian Chemical Journal are wanted, dating from July to December inclusive. Full price will be paid for copies received with reading matter pages in good condition.

IT is to be hoped that all in places of authority who read Prof. Walker's article on "Chemistry in the life of a Nation," will see that chemistry is a term of far broader significance than has been commonly realized. The work of the chemist touches every department of industrial and national life. The great war has proved it, but the new demands which chemistry will make for peace industries remain yet to be impressed on the public mind.

THE immense value to the people of Canada of the work done by the laboratories of the Inland Revenue Department is suggested by the brief sketch given by Mr. Westman in this issue. The best work is often the least known to the public, and it sometimes happens that the most valuable safeguards provided by the chemists in the people's behalf are only indicated by the clamors incited against the officials by the interests affected.

THE embargo placed on the export of molybdenum from Canada bade fair to cause serious damage to the industrial interests of Canada, Great Britain and the United States, apart from the loss it would occasion to the number of people who had discovered and were prepared to develop molybdenite mines. The effect of the embargo was to confine the exportation of these ores, concentrates and alloys to the works controlled by the British Government. Last month the Canadian Government wisely decided to relax the order by permitting licenses for the free export, to approved consignees in the United States and France, of both molybdenum and tungsten, with their ores, concentrates, alloys and chemical salts and acids. Shippers must also obtain a license from the United States Government to import these products. Now that a free market is again open a number of the promising new deposits that have been discovered in Ontario and the West will no doubt be developed with important results.

The Coming Convention of Chemists

WITH the assured establishment of a Section of the Society of Chemical Industry in Ottawa a long needed step in advance has been made in the interests of applied industrial chemistry in the Capital City. Following two well attended preliminary meetings a programme for the remainder of the Society's year has been worked out and a chairman of the Ottawa Section appointed in the person of Dr. A. McGill, chief chemist, Inland Revenue Department. Dr. McGill is one of our best known Canadian chemists and is outranked in length of service to this country by few men.

It is more than probable that the next general annual meeting of the Society of Chemical Industry will be held in Ottawa early in April or May. It should become the natural office of every chemist, metallurgist, and chemical engineer to appreciate not only the significance of such a gathering himself, but to see that the firm he represents and the general public equally realize the value of such a convention. In times such as these, when a year means more to the advancement of chemical industries in Canada than did a life time previous to the war, it is advisable that some means of general concourse may be provided and enjoyed by all Canadian chemists. Through the formation of this new Section of the Society of Chemical Industry in Ottawa machinery has been created whereby that city can for the first time welcome with an established organization Canadian chemists and engineers.

Within a short time the Dominion Government has greatly extended its interest in the development of chemical industries. Many investigations of natural resources have been carried out. Forestry, agriculture, mining and water power possibilities are receiving continually increased attention. Through its Advisory Research Council, and its own well equipped laboratories attached to nearly every department, the Government has placed itself in a position to direct and materially assist not only those industries well established, but also those that are certain to take a part in the future development of this country. With a central, national, scientific organization of this kind in the process of evolution it is only natural to expect that Ottawa should participate more and more in such work. The city itself offers a central meeting ground at the present time for Canadian manufacturers, whose industries are stimulated by the enormous Governmental war expenditures. Added to this are the well known attractions of the beautiful city and the fact that at this period the newly elected House of Commons should be in session.

It would seem then that the Society of Chemical Industry has proposed very wisely both the right time and place for holding such a convention. Every one who is interested in chemistry in any way should, if possible, be present. An opportunity is offered for everyone to keep in touch with the wonderful advances that have been made in this country and are now under way. More important than anything else is the fact that such a gathering of chemists allows each one to derive inspiration from personal contact with men in their own and other lines of work. Together they can review and visualize more clearly the extent and nature of the vital problems of industrial chemistry that must be dealt with in the near future.

Since the above was written a committee representing the sections of Toronto, Ottawa and Montreal, has met in Toronto and has recommended the proposed meeting in Ottawa, and suggested the latter part of May as the time most convenient.

The concluding part of the article on the carbonization of Canadian lignites, by Messrs. Stansfield and Gilmore, will appear in a later issue.

APART from the war problem of food production and the problems arising from the shortage of many manufactured articles, one natural result of the development of the chemical industries is a closer attention to the recovery of materials heretofore wasted in our reckless and prodigal economics. One authority commenting on reports of official investigations estimates that from the garbage treated at the reduction plants of the cities of the United States there can be produced annually about 4,500 tons of nitrogen; 12,500 tons of bone phosphate of lime and 1,250 tons of potash; while from the garbage grease, 8,000,000 pounds of nitro-glycerine and 200,000,000 12-ounce cakes of soap can be made. Assuming the garbage of Canadian cities to be of the same character the by-products of Canadian city garbage can be fairly estimated by dividing the above amounts by twelve.

Nitrogen—A National Problem

IN this issue some facts relating to the production of nitrogen and its compounds are presented in a non-technical form. It will be seen, without any knowledge of chemistry, that the production of nitrogen in its various forms is a tremendously important need for carrying on the war, and that it is equally essential for the requirements of peace.

Thrown back upon her own resources when the war cut off Germany from imports of nitrates from Chili and elsewhere that country developed the electro-chemical processes of fixing nitrogen from the air to a tremendous extent. France, Italy, Norway and Sweden have established electro-chemical works for similar purposes, and now, as already mentioned, the United States Government is creating such works at a cost of $50,000,000.

In Great Britain Sir William Crookes and Lord Rayleigh had proved the great possibilities of the electric arc in the production of nitrogen, and when the war broke out the need for munitions for army and navy brought this problem home with the result that a Nitrogen Products Committee was formed by the Ministry of Munitions in 1916—a step which coincided with the inauguration by Germany of the submarine campaign. It was decided to develop the output of ammonia as a by-product of the gas and coking plants; also the installation of ammonia oxidation plants, and a plant for the synthetic production of ammonia while the erection of a cyanamide plant was recommended. The lack of large water powers was a difficulty in developing the electrical processes, and the use of the coal of Britain as a source of the power was advised.

Since the British committee are offering to place at the disposal of the governments of the various Dominions and India all the data gathered, and since the United States Government has taken such prompt and spirited action, there is a call to the Government of Canada to make an immediate and definite move in devoting some of the immense unused water powers to making this series of chemical products, not simply for war purposes, but because more nitrogen is the hope of Canada's agricultural and industrial prosperity. The figures given in this issue make these points clear, and it is enough in that connection to add that the peace demands of recent times have caused the world's production of nitrogen to be doubled every ten years. The war has, of course, greatly accelerated this demand. The greater the amount of power required, and the greater the time of developing the power, the more urgent is the call to make an early start in Canada on a scale to meet the world's needs.

The Alcohol Question

BECAUSE alcohol in some form is used in such a great variety of commercial products, chemically produced, the war has made the problem of industrial alcohol a very acute one in many countries. In the case of Canada, the revolutionary step, taken at the close of last year, of prohibiting the manufacture and importation of liquors containing over two and a half per cent. of proof spirits, complicates the problem greatly, since so many and various industrial processes are involved. To appreciate this one has only to remember that fifty kinds of dyestuffs require ethyl and methyl alcohol and as many colors outside of textile dyestuffs require alcohol; that fulminates and smokeless powder, fruit flavors, synthetic perfumes and drugs, photographic chemicals, sulphuric and nitrous ethers, acetates, various anæsthetics, vinegar, certain soaps, are made by means of it, while denatured spirits are used in an almost endless variety of manufactured articles counted as necessities for rich and poor.

The fact that the war has compelled the people of belligerent countries to make more spirits for war uses and less for drinking purposes has brought a new demand for whiskey and other alcoholic drinks from Canada as is evident from the trade returns which show that distillery products to the amount of 1,289,117 proof gallons were exported from this country last year compared with 808,139 gallons the year before, the average exported before the war being less than 400,000 gallons a year. The quantity actually produced last year was 6,400,000 proof gallons, or about double the production of the previous year. A considerable amount of these exports were in industrial alcohol.

Since the war there has been a notable increase in the manufacture of alcohol for industrial purposes in the United States, due largely to the development of the chemical and related industries. Before the war the production of denatured alcohol in the United States was under 2,000,000 wine gallons a year, while in 1914 it was over 10,000,000 gallons and the returns of last year will show a large increase. The quantity of spirits distilled from materials other than fruits in the United States has increased from 174,611,000 gallons in 1914 to 277,834,000 gallons in 1917. While alcohol for industrial purposes now constitutes the greater part of the total production of the United States the situation in Canada is the reverse, alcohol for drinking purposes being here the chief element in the business. This is especially interesting when the problem is viewed from the political angle. On January 18th three deputations interviewed the Prime Minister and the Hon. N. W. Rowell, on the alcohol question, and at no time in the interviews was even a hint given that alcohol ever was or ever could be applied to industrial uses. It was evident, however, that larger stocks of drinkable alcohol existed in Canada, or were on the way, than was supposed, and the purpose of one of the deputations was to get an extension of the period for importations.

Whether the purpose of the Government to prohibit the manufacture or importation of alcohol is carried out in good faith or not, the various manufacturers and other technical users of alcohol should at once advise the authorities as to what would happen to their business should an order be carried out which takes no account of the needs of those who use, but do not drink, the products of alcohol. This question cannot be settled as a social problem only, and if the country is to have bona fide prohibition, then the existing stocks might be taken off the hands of distillers and dealers by the Government itself and used as required in the industries.

We hope to have this question more fully discussed in another issue, as in some respects the situation in Canada is peculiar.

The Alcohol Question

According to official notice in the Canada Gazette the order-in-council forbidding the importation of intoxicating liquors into Canada after December 24th last, unless actually ordered before that date, has been modified by permitting shipments made up to January 31, 1918.

This action was taken because of representations made concerning transportation difficulties, by deputations that waited on the Government on the 18th January. At the same time a delegation of wholesale liquor dealers from the West asked that when the provisions in regard to inter-provincial trade (prohibiting the shipment of liquors into provinces that have prohibition laws) go into effect on April 1st next, they be allowed additional time in which to dispose of existing stock. Consideration was promised.

Still another delegation representing the brewers asked that beer of an alcoholic strength of 2½ per cent. be allowed instead of 2½ per cent. proof spirit. If this request is granted it will permit beer having an alcoholic content equal to 5 per cent. of proof spirits.

Another deputation was from the grape-growers and wine producers of the Niagara peninsula who asked that native wines produced from Ontario grapes should be excepted from the terms of the prohibition order. They pointed out that there is in the Ontario Temperance Act a provision which allows native wines to be sold in Ontario, although they contain from ten to twelve per cent. alcoholic strength. The Government promises to consider the request when the question of prohibiting manufacture is dealt with.

A correspondent of The Canadian Chemical Journal, commenting on these deputations, says:

"At no time during the whole discussion was any mention made of the fact that alcohol ever was or ever could be used for industrial purposes. It appears that there are rather large stocks of alcohol on hand at present due to the natural stimulus that the trade has felt since the foreign importations have been cut off. Mr. Ferguson, of Winnipeg, said that the various stocks of alcohol in the country were much higher than was generally considered. The whole question seemed to be how could alcohol be fed to the people and no one seemed to consider the real problem of making some use of it. The technical users of alcohol should advise the Government of their probable requirements because at the present time it seems beyond the conception of the Government that alcohol might serve some purpose other than drinking. Such alcohol as is in the country should be taken off the market by the Government and used as required for industrial purposes. Had a chemist been receiving the deputation some such idea might have filtered through, but the social problems were the only ones recognized by the Government."

With regard to alcohol from wood waste our correspondent in New York, writes:

"There are only two plants in the United States at present producing alcohol from sawdust and wood waste. One of them is owned by the Dupont Company, and is situated somewhere in South Carolina and is, I understand, quite successful. The other is somewhere in Louisiana, but its commercial success is not certain. It has been run intermittently for a few years. Numerous other attempts have been made but abandoned. There seems to be no reason at all why the process should not be a commercial success, provided it is not hampered by adverse legislation, and provided the chemical and engineering details have been based on commercial conditions."

A Canadian chemist offers the following observations on the situation:

"There are no reliable figures relative to the amount of alcohol produced annually in the United States from wood waste. I know, however, that it is relatively not very much. They are working hard at it and of course methyl alcohol will be produced in direct proportion to the amount of coke as it always has been a distillation product. But the production of ethyl alcohol from cellulose and other wood fibre involves cheap sulphuric acid and fermentation processes. As far as one can tell the Government of Canada has no particular policy relative to the production of industrial alcohol at the present time. It is chiefly concerned just now with cutting down the human consumption. Eventually we will be forced to stimulate its production from such things as potatoes, wood, etc., using in general some process of fermenting sugars. Germany developed the potato method to a wonderful extent. They had the advantage of cheap fertilizer and enormous yields per acre. We can do that. They stimulated the industry by taxing the big fellows more than the little fellows. The Government should not expect to make as much revenue out of alcohol taxation in the future as it has in the past. The ordinary grain fermentation we will have with us until such time as we have developed other processes in the country. Any policy must keep alcohol cheap."

Iron and Steel in Canada, 1917
(January to September)

The Mines Branch of the Department of Mines, Ottawa, has received from the producers complete returns of the production of pig iron in Canada and with the exception of two small plants complete returns of the production of steel ingots and direct steel castings during the first nine months of 1917.

The total production of pig iron during the first nine months was 895,307 short tons, as against 844,717 tons during the first nine months of 1916. The average monthly production in 1917 was 99,478 tons, as against an average monthly production throughout 1916 of 97,438 tons.

Furnaces were in blast at Sydney and North Sydney, N.S., Hamilton, Port Colborne, Sault Ste. Marie, and Deseronto, Ont. Small quantities of pig iron were also produced in electric furnaces from scrap steel at Orillia, Collingwood, St. Catharines, Toronto, Ont., and at Montreal, Que. The total quantity of pig iron thus produced in electric furnaces during the nine months was 9.983 short tons.

The total production of steel ingots and direct castings during the first nine months was 1,265,183 short tons, as against 911,054 tons during the first nine months of 1916. The average monthly production during the first nine months of 1917 was 140,576 tons as against an average monthly production throughout 1916 of 106,268 tons.

The production of steel in electric furnaces included above was 30,960 tons during the first nine months of 1917 as against a total of 19,639 tons produced throughout 1916. The production of steel in electric furnaces in September was over 5,000 tons or at the rate of over 60,000 tons per annum.

Separation of Aromatic Sulphonic Acids from Sulphuric Acid

The method, patented by L. M. Dennis (Amer. Pat. 1,228,414, June, 1917), consists in extracting the sulphonic acids from admixed sulphuric acid by agitating with toluene, or some similar liquid which does not dissolve sulphuric acid, at 100°C. The toluene solution is then separated and cooled to 5°. The sulphonic acid is converted into its sodium salt by adding sodium hydroxide or carbonate. The toluene may be used for the extraction of other portions of mixed acids.

H. A. Crown, chemist at the works of the Canada Glue Company, Brantford, Ont., has gone to the works of the American Glue Company, Boston, Mass. His place in Brantford is taken by J. W. Coy. Mr. Coy graduated in chemistry at the Carnegie Institute of Technology, Pittsburg. After doing research work in the United States Bureau of Mines he was employed till coming to Canada, at the Springdale plant of the American Glue Company.

Chemistry in the Life of the Nation

W. O. Walker, M.A., Department of Chemistry, Queen's University

It has been said, before the War, that England would require to be in danger of her very existence to properly realize her deficiencies, to awaken from her lethargy fostered by wealth, from her political inefficiency, her class distinctions, her stunted scientific development. We are now inclined to believe that there was much truth in this prophecy, for we have witnessed during these three and a half years of war such a transformation as none of us deemed possible in so short a time. We know also that it is not only England that is undergoing the transformation but practically the whole world. The war has tested our abilities in almost every line and we are having to put forth all our powers to withstand the strain.

My purpose is to draw the attention of the reader to some of the most outstanding points in the scientific development during these years, and only those achievements in which chemistry has played the leading role, and to try to show wherein chemistry is a vital factor in the life of the nation, not only in emergencies, but at all times.

Dr. Julius Stieglitz, professor of chemistry at the University of Chicago, and president of the American Chemical Society, in his presidential address at the September meeting of the society at Boston, said:

> "The great European War, and now our own entry into the world struggle of free democracies against the organized military power of the last stronghold of feudal privilege in Western civilization, have brought home to the public as never before in the history of the world, the vital place which chemistry occupies in the life of nations. What is it, indeed, that is so fundamental in this science that a country's very existence in times of great emergencies and its prosperity at any time may depend on its master minds in chemistry? It is the fact, summed up in the fewest possible words, that chemistry is the science of the transformation of matter."

This definition of chemistry shows that it is a fundamental science, a science which we are throughout our lifetime necessarily, even if unconsciously, a part and parcel of, since the material of our bodies is at all times participating in this transformation or change of matter.

In England before the war, the terms, "chemist" and "druggist" had the same meaning to the average person,—not so, however, in Germany. There a chemist was recognized as a highly educated professional man, indispensable to the industries of the nation, employed in numbers by nearly all the large industries, and commanding appropriate remuneration. In England and America a few industries employed chemists in small numbers, and often paid them ordinary workmen's wages, with the result that the profession of chemistry was almost unrecognized, and the industrial development was not comparable with that of Germany.

At the outbreak of hostilities, Britain was suddenly confronted with chemical problems, the magnitude of which was inconceivable. Indeed so difficult was it for her to grasp the magnitude of the task that she allowed many of her all too small army of chemists to go into the trenches.

What were some of these mighty tasks that only chemists could solve? There were explosives to be made by the millions of tons. The manufacture of many kinds of steel had to be chemically controlled. There were dyes to be made, not only for soldiers' uniforms, but for the numerous industries of the country using dyestuffs that had formerly been manufactured in Germany. There were medicaments required both for the army and the civilian population, many of which had never been made in Britain, but which were indispensable, and needed at once. There were abrasives to be made for use in gun making, aluminium for aeroplanes, copper for shells, acids, alcohol, acetone for preparation of explosives, oils and hundreds of other products, all needed in quantities never before dreamed of, and needed at once.

British and French chemists performed the marvellous feat of stepping in and supplying the needs in a truly wonderful manner. They upheld the profession of chemistry most gloriously in this crucial test. Explosives, steel, copper, alloys, foods, guns, ships have been turned out in overwhelming quantities.

Under the pressure of time chemists were called upon to solve scores of new problems. English chemists have devised means of combating poisonous gases. Professor Baker, of the Royal College of Science, London, went to France after the first gas attack to investigate the gases used, and on his return succeeded in utilizing chemicals which completely destroyed the effects of gas. Gas masks using these chemicals were manufactured to the extent of over eight millions. These proved effective for some time, but as the Germans later employed other gases it was found necessary to alter the form of gas mask and to provide other chemical antidotes. This problem in itself has been an everchanging and perplexing one, and the latest British respirator is a marvel in efficiency, so much so indeed, that our new ally, the United States, after thorough investigation of the respirators in use, has, I understand, adopted the British type. This "Box" respirator, so called from the shape of the container for the chemicals, is carried by the soldier in a special knapsack, which although quite bulky, thus adding greatly to the load of equipment carried, is of vital importance. It is an entirely new item of equipment in warfare, has been developed during the last two years by British chemists, and is an illustration of what can be produced by British brains when the necessity arises.

Chemists of the Royal College have also discovered methods of making local anaesthetics for the army, absolutely indispensible and previously made only in Germany. Professors Jackson and Merton, of King's College chemistry staff, have done brilliant work in investigating the chemical composition and methods of manufacturing glass for optical goods, chemical and medical apparatus, and other uses. They have published formulae for manufacture of glass which is quite equal to the best glass ever made in Germany after long years of evolution. The writer has seen glass being made in England which is on a par with the famous Jena product of Germany. English porcelain is now being made which is quite equal to the Royal Berlin porcelain. British dye manufacturers have now succeeded in making nearly all the different dye stuffs that are made in Germany. Many other chemical substances such as photographic developers, drugs, etc., formerly German products, are now being manufactured in Britain.

Even Canadian chemists have been conspicuous. Two young chemists of Toronto have discovered a method for making "Salvarsan," formerly a German monopoly, the principal remedy for syphilis, and are supplying this drug to the Allies. Chemists of Shawinigan Falls, Quebec, among whom is a graduate of Queen's University, have succeeded in making acetic acid and acetone, starting from acetylene and water, and are now turning out acetone in huge quantities for explosives. Another Queen's graduate in chemistry is chief technical advisor at the British Chemical Company's plant at Trenton, Ont., where tri-nitrototuol, the principal explosive used by the British, is made by the thousands of tons. Canadian chemists are now being sought by the Dominion Government to investigate chemical problems of national importance, and we expect this to be of inestimable service to Canadian industries.

American chemists have organized themselves into various committees to solve the many problems presented by the crisis of the war. More than three hundred problems of wide range have already been investigated by them. More than one hundred and fifty chemists are now employed in the United States on poisonous gas production and gas mask protection

for use at the front by American troops. The sensational commercial synthesis of ammonia from the atmospheric nitrogen and subsequent conversion to nitric acid, originated by Haber in Germany some years ago, has been improved upon by an American firm since the war broke out, and the process has been offered to and accepted by the United States Government, free from all patentee's royalties. American porcelain and glassware is a close rival to the English products. The American dyestuff industry is assuming large proportions. In fact American chemists are coping with the situation in a truly laudable manner.

It must be admitted that the profession of chemistry has been the one most instrumental in saving us from our foes. Had we no chemists to produce our explosives, munitions, medicaments, and scores of other products we would long ago have been trodden under the foot of Germany.

Dr. Marston Taylor Bogart, chairman Chemistry Committee, National Research Council for the United States, says:

> "Wars are not fought as in the olden times when individual physical prowess was the chief deciding factor, but modern warfare is a highly complex problem in applied science, and its outcome is decided largely in the laboratories and factories.
>
> "The maintenance of our training schools for chemists is of fundamental importance since upon these rests the responsibility for keeping up to full strength and efficiency an army of chemists. They are the recruiting stations for our industries and for our research laboratories, and must see to it that a steady flow of new effectives is kept moving towards the industrial and military fronts. To disorganize our educational institutions by withdrawing so large a proportion of teachers that the chemical students cannot be handled properly would seriously jeopardize the future of our whole country. The chemistry teacher, therefore, who sticks to his task as a teacher is not in any sense a 'slacker,' but is rendering the most valuable kind of patriotic services, and it should be recognized!"

The average business man regards as chemical only those activities which have to do with explosives, drugs, dyes, acids, etc., whereas there is scarcely any industrial activity which does not have its chemical aspect.

Agriculture, the foundation of our national wealth, is mainly photo-chemical in aspect. Further, its success depends much upon chemical fertilizers and sprays. The uses that cottonseed has been put to by chemistry has added two hundred million dollars annually to the value of the cotton crop; to say nothing of the explosives made from cotton. Chemistry has made corn to yield oil, dextrine, glucose, starches and adhesives. Chemical laboratories supported for service to agriculture are found in ever increasing numbers in the various countries.

Railroads and canals are constructed largely by means of chemical substances—steel, cement, dynamite. The cyanide process for the extraction of gold established the prosperity of South Africa. Chemists have succeeded in converting atmospheric nitrogen into indispensible fertilizers for the land, have discovered methods of making dyestuffs of almost every hue and grade of brilliance conceivable, have made with unfailing patience and labor blessed anaesthetics and other medical compounds, without which man's body would often be in agony of pain, and his life be prematurely blotted out. Chemists have discovered means of rivalling nature in many of her products. They have made many of our most pleasing perfumes in their laboratories without resort to nature's blossoms. They have discovered methods for making from chemical compounds such as nitric acid and cellulose, not only our most useful explosives, but also much of the silk that is now used. They are constantly turning their attention to our large industrial waste products and converting them into most useful substances. They have succeeded in making many precious stones such as the ruby and sapphire by combining under proper conditions certain chemical compounds. The paints we use for our buildings are products of the chemical laboratory. The material for our newspapers is made by the action of chemicals on the wood from our forests. Chemists are busily at work delving into the mysteries of that greatest of all chemical laboratories, the human body, with results that are daily being demonstrated by the rapid advancement in the treatment of disease, so that the average length of human life has been doubled.

Although much has been accomplished in the advancement of chemical knowledge in the English speaking countries it is the result mainly of individual effort. The statesmen of the various countries have not been prominent in attempting to organize the work, nor to provide funds for carrying it out. During the last two or three years a beginning has been made on Government directed scientific research, and funds are now slowly being supplied for this purpose. In an editorial in "Nature," an English journal, for October 18, 1917, the following statements occur:

> "Principles which have been persistently urged by a couple of generations of scientific men are now being proclaimed from the housetops, and are heard in the highways, with the result that our political leaders are beginning to follow them. . . . We have waited more than forty years for this necessary endowment of research, and the country has lost incalculable millions because no statesman had sufficient foresight to take heed of the warning and advice of scientific men at a time when profitable action was clearly indicated."

What is the duty of educational institutions to this work of research and scientific industry which is sweeping over the country? Professor Pope, president of the British Chemical Society, says in a lecture to teachers:

> "Amongst our young men is always found a certain proportion attracted by temperament and by latent power toward the natural sciences . . . a type endowed by a high order of intelligence, a large measure of manipulative dexterity, and a keen desire to peer a little further than has been seen before into the mysteries of the universe. . . . Their intelligence and their aptitude for assimilating knowledge has led the classical teacher to press upon them the advantages of a classical career. The law again absorbs a large proportion of the young men of the nation who are best fitted for a scientific career. . . . If our country is to cope successfully with the huge constructive problems which are now being thrust upon it, some method must be devised for preventing the reckless waste of intelligence and ability upon quite unworthy objects which now goes on. . . Nothing is more saddening than to read the reminiscences of some great legal luminary, a man almost always endowed with exquisite intellectual powers and with immense virility, to note the delight which the writer displays in each piece of miserable legal chicanery in which his own wits have been pitted against others of similar brilliance, and to realize that this splendid personality has passed from among us leaving nothing for which mankind can call him blessed. . . . It is essential that public opinion should become sufficiently educated that concentration upon scientific progress is not only urgent in time of war, but that it is vital in time of peace. That we cannot afford to spare any effort which the nation can make in the enlistment of its best young intelligence in the service of science . . . all should realize that scientific progress is synonymous with national progress. To grasp these conclusions and to apply them in dealing with the young, is one of the major duties which has to be allotted to our school teachers."

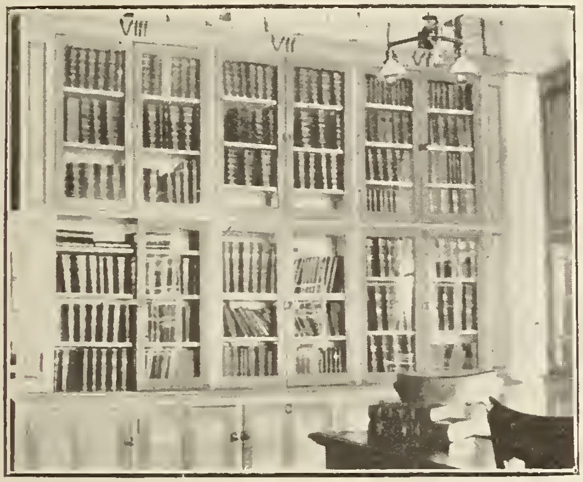
Since the chemist is purely a product of the university, we must look to the university to produce our chemists. Canadian universities should surely realize the pressing need of putting

at the disposal of their chemistry departments all the encouragement and resources they can give. If our universities fail to grasp the opportunity they now have to prepare Canadian chemists to do their share in advancing the scientific development of our industries they must indeed be accused of great lack of service to the nation.

The Laboratories of the Inland Revenue Department, Canada

By L. E. Westman, M.A., Public Analyst

In 1875 an "Act to Prevent Adulteration of Food" became law in Canada. This was based on the "Sale of Foods and Drugs Act," which came into force in England during the same year. The enforcing of this Act was placed under the jurisdiction of the Commissioner of Inland Revenue who, in 1876, first appointed analysts and food inspectors. From the date of these appointments the laboratories of the Inland Revenue Department may be said to have had their birth.



Corner of Library, Laboratory, Inland Revenue Department

One analyst was appointed in each of the four cities: Halifax, Quebec, Montreal and Toronto. The only surviving member of the first quartette of Canadian public analysts is Dr. W. Hodgson Ellis, Dean of the School of Practical Science, Toronto. In those days the analyst provided his own laboratory, and under this policy public analysts were appointed from time to time in the larger cities during the years 1876 to 1884. In 1884 a public analyst was appointed in Ottawa. From this time on a government-owned laboratory at Ottawa gradually took over all of the work formerly done by the private laboratories.

At the present time there are four laboratories employing twenty-one chemists. The main laboratory at Ottawa employs fifteen of these: six others are in charge of branch laboratories at Halifax, Winnipeg and Vancouver. These branches were established in 1915 and were the direct outcome of the expansion of the work and difficulties arising from shipping samples such long distances. The staffs are composed, as a rule, of men who have had considerable general chemical training, as well as the advantage of post-graduate study. All are required to pass the public analysts examination for Canada.

Essentially the laboratories are fitted up for the analyses of foods and food-products, and their bacteriological examination. They are, therefore, analytical laboratories and their detailed description is not necessary here. It is sufficient to say that the best and most modern equipment for making analytical determinations is to be found in each. At the present time not more than two chemists occupy a single laboratory-unit or room which is supplied with facilities for making all ordinary determinations. Special apparatus that may not be moved is set up in common rooms and is used there as required. One suite of rooms is completely fitted up for bacteriological work.

The technical work of these laboratories arises mainly from the following acts:

1. Adulteration Act.
2. Fertilizers Act.
3. Commercial Feeding Stuffs Act.
4. Proprietary or Patent Medicines Act.

Besides these regular channels a large volume of work arises from matters connected with Excise, investigations of special nature, and the general analyses connected with branches of Government work outside the Department of Inland Revenue. Since the outbreak of the war this work has been greatly increased through the free use made of these laboratories by the Department of Militia and Defence for the testing of foods, drugs, and other miscellaneous supplies bought by contract. In addition to this work a great variety of samples for analysis is received from the general public.

The technical work of these laboratories is a direct protection to the Canadian people. It is the business of these laboratories to see that proper food standards are prepared and enforced which protect not only the consumer but the retailer and manufacturer as well. If no such machinery existed, the consumer would be without means for his proper protection against fraud and adulteration in food materials. The public as a whole is utterly unable to protect itself and must place its faith in this system. As a matter of fact the people know nothing about this organization, but the laboratories keep this faith in trust just the same. The Department has full power to institute the prosecution of all parties who offer for sale any food or drug that falls short of established standards. The general tone of such action is a good protection to the public.

In order properly to estimate the quality of an article on the market at any one time the method of procedure is as follows: Samples are collected in every province by food inspectors. These are analyzed and reported in bulletin form. Some three hundred and eighty bulletins have been published and may be received free of charge by anyone interested. As a rule about twenty samples are collected per million of population. This seems a very small number but until the technical staff is greatly increased it is all that can be given proper attention.

Typical Working Bench showing Large Fat Extraction Battery. Inland Revenue Laboratory.

During the last twenty-five years a great improvement may be noted in the quality of many common articles of food. The percentage of adulterated samples is gradually becoming lower. The aim of this work is still further to reduce this percentage and to give the Canadian public the best protection possible through the medium of scientific control. This chemical detec-

tive work can only be carried on to success with the heartiest and most intelligent assistance of the public behind it. It is the desire of the Department to cultivate this measure of co-operation as fully as possible. Every complaint from any individual or firm receives official recognition.

It may be seen then that the function of the laboratories of the Inland Revenue Department is to control in a scientific manner the food and drug supplies reaching the public. The minor functions are exceedingly diverse and include analytical work of a most general nature. Research work is carried on in connection with the creation of food and drug standards and methods of analysis. Although unobtrusive in its nature the work of these laboratories bears a direct relation at least three times a day to the life of every person living in Canada.

A Danger in Asiatic Beans

During the last six months there has been a notable increase in the importation of Asiatic beans into this country. These beans do not grow under the climatic conditions existing here, but are native in the more tropical regions of South Eastern Asia. The small production of Canadian beans, coupled with higher prices, has encouraged the introduction of these foreign varieties into Canada.

Certain facts in this connection, however, should be quite clearly pointed out and appreciated by importers and users of these beans. Chemical analysis shows that Asiatic varieties of beans contain glucosides which on hydrolysis yield hydrocyanic acid (prussic acid). This very active poison does not occur naturally in the native beans of North America. It may be present nevertheless in these imported varieties in amounts as great as 26 parts per 100,000. Up to the present time beans running as high as 20 parts per 100,000 have been allowed entry into Canada and as yet with no apparent ill effect. This crowding of the Canadian market with these beans is partly due to action taken by the United States Government which has reserved the right to reject any shipment showing "appreciable amounts of prussic acid." (Service and Regulatory Announcements, No. 219—published July, 1917).

It is quite evident that the American Government has set a much lower limit of prussic acid than 20 parts per 100,000. The French Government in 1912, after having this matter brought to their attention through serious illness and death arising from excessive use of these beans (the Java variety) adopted the limit now used in Canada of 20 parts per 100,000 of prussic acid. Up to the present time other European authorities, under stress of war time necessity, have paid no great attention to this matter.

The fact that there seems to be very little uniformity in the prussic acid content of various lots of these beans has made their rigorous inspection at ports of entry a necessity. Startling variations may exist between different bags in the same shipment. This necessitates careful mixing of the whole shipment and good sampling before any analysis may be made the basis of an opinion relative to the safety of this product as a human food.

During the period, June to December, 1917, 532 shipments in bulk of these beans have reached Canadian ports of entry. Of these 446 shipments came to Vancouver, 24 to Toronto and 18 to Montreal, other places receiving smaller consignments.

These importations included beans of many varieties. Analysis by the Department of Inland Revenue shows that the prussic acid content ranged as follows:

Containing no prussic acid	280 samples
Containing traces up to 10 parts per 100,000	49 "
Containing from 10 to 15 parts per 100,000	121 "
Containing from 15 to 20 parts per 100,000	63 "
Containing more than 20 parts per 100,000	19 "

Although the advisability of continuing the importation of beans of such a high prussic acid content may be questioned it must be pointed out that when properly soaked, washed, and steamed in cooking, the prussic acid passes off, being volatile in steam. If the steam is allowed to escape from the vessels in which they are cooked these beans, which yield excellent food values, will generally be safe.

Coming Events

Annual Convention of the Canadian National Clay Products Association at the Prince George Hotel, Toronto, January 29th to 31st, 1918.

Annual Meeting of the Toronto Section of the American Institute of Electrical Engineers at the Engineers Club, of Toronto, April 19, 1918. A meeting of officials of the Institute will be held at Cleveland, Ohio., on March 8th, to which members of the Toronto Section are invited.

The Annual Meeting of the Toronto Section of the Society of Chemical Industry will be held at the Engineers Club in April, at a date to be fixed shortly.

The Canadian Master Painters Association will hold its annual convention in Hamilton next July, the programme and date to be arranged by a committee.

Annual meeting of Ontario Good Roads Association at the County Chambers, Adelaide Street East, Toronto, February 27th to March 1st.

The next convention of the Natural Gas Association of America will be held not in Louisville, Ky., as planned, but in Pittsburgh, Pa., on the 21st and 22nd May.

The Canadian Lumbermen's Association will hold the annual meeting in Montreal, February 5th, at the Windsor Hotel.

The annual meeting of the Canadian Forestry Association will be held in Montreal, February 6th.

The Canadian Pulp and Paper Association holds its annual meeting at the Ritz-Carlton Hotel, Montreal, February 1, 1918

Foreign Trade Enquiries

The names and addresses of the firms making these inquiries can be obtained only by those especially interested in the respective commodities upon application to "The Inquiries Branch, The Department of Trade and Commerce, Ottawa." In writing correspondents should quote the number of the enquiry. The initials, "B.T.C." indicate that the enquiry for the address should be directed to the British Trade Commissioner in Canada, 363 Beaver Hall Square, Montreal.

1562. A Midland (England) firm wishes to buy oxides of nickel.

1569. A firm in Melbourne, Australia, specializing in chemicals and drysalteries, invites correspondence and quotations from Canadian manufacturers and exporters of these lines and also on all classes of raw materials used in manufacturing.

1571. A wholesale drug company at Sydney, Australia, asks for samples of composition collapsible tubes (made of lead in centre and coated with tin inside and out, about 6 per cent. tin in total tube; f.o.b. steamer quotations for large quantities are desired. Pure tin tubes are too costly for the purpose the composition tubes are required.

1574. A Melbourne firm asks for samples and lowest wholesale f.o.b. steamer quotations on formaldehyde in wood casks.

1575. An Australian firm, doing an extensive business in wood alcohol, invites samples and f.o.b. steamer quotations for large quantities of this spirit. The packing to be in casks, or preferably in steel drums containing up to 100 gallons. The samples must first be submitted to Government inspection and analysis before permission to import will be given.

1576. A firm in the South of England asks for the addresses of Canadian manufacturers who can supply genuine aceto-arsenite of copper (emerald green) dry colors, for which they are prepared to place an order.

1580. A firm in Liverpool wishes to get into communication with exporters of nickel oxide, white powdered arsenic, sodium acetate.

1649. A London company desire the addresses of Canadian manufacturers of wood distillation products, such as acetic acid, formaldehyde and acetone.

1674. A Johannesburg firm in the mining trade asks for catalogues, etc., from Canadian manufacturers of mining and railway supplies, wire rope, machinery, mine cars, tools and other lines.

Spruce Turpentine

From 1,500,000 to 2,000,000 gallons of "spruce turpentine" (sulfite turpentine) are going to waste annually in the mills of the United States and Canada using spruce and balsam for pulp. This oil is formed during the cooking of the chips in the sulfite digesters and escapes with the steam in the blowing-out process. The term "turpentine," as applied to this material, is a misnomer, for it contains only traces of terpenes; the chief constituent, approximating ninety per cent., is cymene. Recovery of the crude product has been carried out in a few mills, but no market was developed sufficiently to justify the expense of recovery. This material assumes at the present time a greater importance than hitherto accorded it because of its possibilities as a source of toluol.

Patents have recently been issued to R. H. McKee for a process in which the dried spruce turpentine is heated with aluminium chloride to about the boiling point of the turpentine. The products formed are toluol, propane and a small amount of tar. We are informed that there is a plant in Philadelphia carrying on this process, but so far only turpentine has been obtained to run about one day a week; the sulfite mills have been unwilling to take this trouble to collect and ship the turpentine.

Moore and Egloff (Met. and Chem. Eng., Vol. 17 (1917), 66), studying the action of aluminium chloride on pure aromatic hydrocarbons, obtained a yield of 14.3 per cent. of toluol from cymene.

Schorger (J. Am. Chem. Soc., Vol. 39 (1917), 2671) studied the action of aluminium chloride on cymene under varying conditions of temperature, time, amount of reagent, etc. He mentions the interesting fact that B. T. Brooks, by removing the light, low-boiling reaction products as rapidly as they are formed, obtained forty per cent. of toluol by treatment of cymene with seven per cent. of aluminium chloride.

A still more interesting possibility is suggested by the work of Boedtke and Halse (Bull. de la Soc. chim., Vol. 19 (1916), 444). By heating cymene, dissolved in ten times its weight of benzine, with aluminium chloride a true reversal of the Friedel-Crafts reaction was obtained. Ninety grams of cymene yielded forty-four grams of toluol and sixty-eight grams of cumene eighty and eighty-five per cent., respectively, of the theoretical yield).

If these results hold true on a commercial scale, a new source of toluol for munitions and dyestuffs is indicated. Furthermore, the ease of oxidation of cumene to benzoic acid suggests the release of the toluol which is now oxidized to benzoic acid.

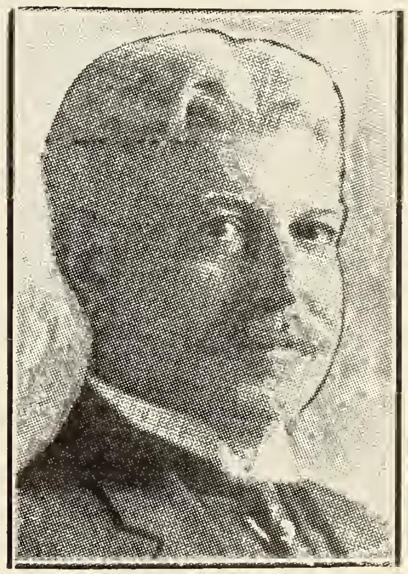
It is unfortunate that Boedtke and Halse have included so few details of their investigation. The published results are so striking that they suggest the necessity of further work on this interesting reaction. Perhaps the mills have been throwing away material of far greater value than they supposed.—Journal Ind. and Eng., Chemistry.

The Chrome Situation

A conference was recently held in Washington between some of the larger manufacturers of bichromate of soda and bichromate of potash and the official Tanners' Council to consider the chrome situation for the year 1918. The meeting was arranged by C. F. C. Stout, vice-president of the council, and the following chrome manufacturers were represented: Mutual Chemical Company of America; Martin-Dennis Company, Newark, N.J.; National Electrolytic Company, Niagara Falls, N.Y., and the Natural Products Refining Company, Jersey City, N.J.

The supply of chrome ore, which is the basis of the chrome products as used in the chemical industries, promises to be less than the needs of the country. The manufacturers of steel requiring chrome, it is stated, could use all of the chrome ore which is imported into this country and all that is produced locally. The Government, however, appreciates the need of the tanners and other users is just as vital as that of the steel men and seems disposed to properly adjust the supply between the various industries requiring chrome.

It is stated that the domestic production, which is reported to be about 48,000 tons for 1917, cannot be largely increased, and it is also claimed that the domestic ore is not suitable for the production of bichromate of soda or bichromate of potash for tanners' use on account of its low grade and also because it is too uneven in quality. On the other hand, it is stated that there is an abundant supply of the ore avilable abroad and the matter of shipping tonnage is the only factor as to it being of sufficient quantity for this country's needs.



E. G. Henderson

When E. G. Henderson undertook the management of the Canadian Salt Company at Windsor, Ont., in 1893, he had the great advantage of years of experience as a civil engineer. On coming to America from Ireland he started near the bottom of the ladder in railway work, but applied himself so well to his work that he became assistant engineer of one of the smaller United States railways. Here Mr. Henderson was discovered by the keen judges of human nature who directed the Great Northern Railraod, and he was offered a like position on that great system. He was afterwards attracted to Canada and took up work on the C.P.R. In 1893 he entered the salt industry of Canada and became vice-president and general manager of the Canadian Salt Company, a company which for years has produced the greater part of the 125,000 tons of salt mined annually in this country. Apart from the salt business the Canadian Salt Company have built works at Sandwich, where the brine, piped from the salt wells, is converted into caustic soda and bleaching powder for the chemical industries. Mr. Henderson was a delegate to the Congress of Chambers of Commerce of the British Empire in 1906, and three years ago was elected president of the Canadian Manufacturers' Association.

Queen's University Laboratories

Department of Mining Metallurgy

(Concluded from last issue)

Gordon Hall, Queen's University

The John Carruthers Science Hall, Queen's University, was built in 1890, for the Department of Chemistry. It was the first Chemistry Building erected by a Canadian University. At one time it housed not only the Department of Chemistry, but all the Departments of the School of Mining. When Gordon Hall, the new Chemistry Building was occupied, Carruthers Hall was re-constructed inside and handed over to the Civil Engineering Department. When Queen's gave up her Arts Building for a Military Hospital, a large part of the Arts Faculty was transferred to Carruthers Hall, the Civil Engineering Department finding temporary quarters with the Department of Mining and Metallurgy.

The Department of Mining and Metallurgy is the oldest one under the Faculty of Applied Science. The instruction in this department was first given in 1893 to a few students, some taking a regular course in mining engineering, while others attended for a shorter period depending on circumstances. However, those in charge realized the importance of the mining profession and the possible development of the mining industry in Canada, especially in Ontario, and the increase in the work has been mainly due to their foresight and interest.

In the early days all the work in the mining and metallurgy was given in a part of the building which is now known as the Mining Laboratory, but the progress was so rapid that an addition had to be made, and the present large laboratory, a three storey building, 86 feet by 43 feet, was erected in 1894. The extended quarters furnished sufficient accommodation until 1898. But still the demand made upon the Mining Department increased, and in order to keep pace with the advances in metallurgy, further accommodation had to be secured. This difficulty was realized by many, but it was not until 1911 when Professor William Nicol made his most generous gift, that a solution of the problem was possible. By Professor Nicol's gift and other contributions from the graduates, Nicol Hall was erected and to-day furnishes accommodation for most of the work in Mining and Metallurgy.

Mining Laboratory

In the Mining Laboratory all machinery dealing with the crushing and concentration of ores is installed. Part of the crushing and grinding equipment consists of a Blake crusher, a set of rolls, ball mill, pebble mill, screening apparatus, and a five stamp battery, each stamp weighing 850 pounds. Adjoining the battery is a set of amalgamated plates for amalgamating gold and silver ores. For concentrating ores there is a three compartment Hartz jig, a No. 5 Wilfley sand concentrating table, a standard size Frue Vanner, and smaller laboratory jigs. A laboratory Case flotation machine was recently purchased to test various ores to see whether it was possible to separate the valuable minerals by flotation methods: Excellent results have been obtained on molybdenite and copper ores.The laboratory also contains an 8 foot Callow tank, a spitzkasten and other apparatus for classifying the crushed ores into various sizes for concentration. Recently a small Dorr thickener was constructed, which gives good results. This machine is used to recover fine particles of ore which usually remain suspended and float away with the water used in washing in the various concentration and crushing processes. A small cyanide plant consisting of an agitator, vacuum filter, filter presses, etc., is used to determine the percentage of gold that may be extracted from ores by treatment with solutions of potassium cyanide. There are also several magnetic concentration machines constructed to separate magnetic ores, e.g., magnetite, pyrrhotite, and siderite from gangue minerals which are not magnetic.

Nicol Hall

In Nicol Hall most of the work in Metallurgy is given. This building was erected in 1912 and the walls consist of grey limestone similar to the other buildings on Queen's campus. It has two main floors, a basement and an attic.

The basement of Nicol Hall is occupied by furnace and chemical laboratories. There is a sampling room, large fire assay laboratory, balance room, parting room, two large chemical laboratories, an electrolytic room, an electric furnace laboratory, and a metallurgical laboratory.

The sampling room contains small laboratory crushing and grinding machines, sampling apparatus, etc. In the assay laboratories there are eight gasoline crucible furnaces, two gasoline muffles, nine gas muffle furnaces, and a blower for supplying compressed air. There is accommodation for forty students in fire assaying and each student's desk is equipped with the necessary fluxes, and other apparatus for making any assay by fire assaying methods. There is a separate room for parting gold and silver, and it is provided with gas, etc., and a set of bullion rolls. Adjacent to, but separated from the parting room is the balance room. In this room there are six gold button balances, three chemical analytical balances, and other balances for different classes of work. The balances are all set on a concrete table supported by concrete pillars resting on bed rock. This arrangement secures complete absence of vibration.

The electrolytic room is equipped with storage batteries and other sources of current, chiefly 110 and 220 volt circuits. In this room all electrolytic assays are made, as well as the testing of electrolytic processes on a small scale. In the electric furnace

room, there is a Hoskin's resistance furnace, a vacuum electric furnace, and an arc electric furnace, besides smaller tubular electric furnaces. The current is supplied by the University power plant at 2,200 volts and the voltage is reduced to as low as 15 volts by means of a transformer in the electric furnace room. The metallurgical laboratory contains one large copper-matting blast furance, 40×24 inches, with which is connected a bag house, about 20 feet high, and a large roasting furnace. The bag house contains sixteen bags, and all gases from the blast furnace pass through the bag before going up the chimney. In this way all fine particles of ore, etc., are removed. This secures the recovery of fine ore particles, and it is also shows how it is possible to prevent compounds formed during smelting from escaping with the gases and settling on the surrounding country to destroy the vegetation The roasting furnace, 10×4 feet, is used to remove sulphur and arsenic from ores previous to smelting in the blast furnace. Several tests are made each year in these furnaces and there is no difficulty in operating the small blast furnace. In the furnace room there is also ample space for conducting small laboratory tests.

The two chemical laboratories are equipped with all the usual chemicals, gas, water, etc., as well as distilled water apparatus, hot plates, and gas and electric drying ovens. There is an excellent draft system for removing all acid fumes. The suction is obtained by means of a suction fan and motor in the attic.

For use in the different laboratories the Department possesses a number of pyrometers for determining the temperatures of the furnaces when tests are being conducted.

On the ground floor there is a large bright lecture room, sufficient to accommodate one hundred and twenty students, one large research laboratory, a dark room for developing and printing photographs, and a well equipped blue printing room. There are also several other offices and cloak rooms on the ground floor.

A large drafting room, lecture room, and a library, as well as offices and cloak room occupy the space on the first floor. The drafting room is well lighted and has ample accommodation for thirty-two students. There is an elaborate catalogue case with maps, catalogues of various machinery, etc., in this room. This is a useful and valuable source of information for the students in their designing. The lecture room has accommodation for forty students. The library contains bound volumes of the transactions of the various technical societies, technical journals, and a most complete supply of text books. Considering the age of the Faculty of Applied Science, the library is unusually well supplied in the variety and number of its text books and bound volumes of magazines and transactions.

Carruthers Hall (Old) Queen's University

Since the Department of Mining and Metallurgy was organized, considerable attention has been given to ore testing and research work. The University will make tests on various ores to determine the best method of treatment, etc., at practically the cost of the work. A large number of investors and owners of properties have taken advantage of this privilege as may be seen by referring to the following lists of ores on which tests have been made. The Mining and Metallurgy laboratories are equipped to test samples of ores as large as five tons.

Concentration tests have been conducted on ores containing graphite, tungsten ore from Nova Scotia, copper ores from Nova Scotia, corundum ores of Ontario, lead ores from British Columbia, copper and nickel ores from Sudbury, cobalt-nickel-silver-arsenical ores from Cobalt, and cobalt-nickel-copper-lead-zinc ores from Missouri.

A large number of stamp battery tests on gold ores have been made, the ores being shipped from all parts of Canada.

By the staff of the Metallurgy Department and assistants, considerable research work has been conducted on various ores. In the laboratories of Queen's University the research work on the treatment of the complex ores of Cobalt and Missouri was conducted and extended. The importance and value of the research department has been proved and it supplies an excellent example of the useful co-operation of the University with industries.

Under this department an investigation dealing with the preparation of chromic oxide, sodium bichromate, and chromic acid has been completed and no doubt a plant will be erected in Canada shortly to produce these compounds from Canadian ores. This will be the first plant in Canada to manufacture chromium compounds.

Also, within the last year, improvements have been made in the treatment of the ores from Cobalt by continued research work. Improved methods for the recovery of lead and copper from Missouri ores have been devised and are being put into operation on a practical scale.

At present an extensive investigation into the preparation of insecticides,—paris green, lead arsenate, and calcium arsenate—is being conducted and the work is progressing favorably. No doubt before long a new industry will be established to operate the various processes.

In conclusion it may be said that the Mining and Metallurgy Department of Queen's University is exceptionally well equipped

Dr. W. L. Goodwin, Dean of Department of Science, Queen's University

to undertake research work in connection with the treatment and recovery of practically all of the common ores and minerals. Investigations could include everything from the concentration of the raw ore to the production of alloys or metals in marketable form.

Stellite, the New Cobalt Alloy

By Thomas Southworth, Vice-president, Deloro Smelting and Refining Company, Limited

In 1910 a business correspondent of Swansea, Wales, in writing us regarding Cobalt matters, enclosed a clipping from an English paper that he thought would be of interest to the writer. This clipping was a re-production of an article that had appeared in an Australian paper referring to an address made by a Mr. Elwood Haynes, of Kokomo, Indiana, before a chemical society in San Francisco. As the article in question stated that Mr. Haynes had discovered a new alloy of cobalt, it naturally was of interest, and I made inquiries as to Mr. Haynes through a friend in Kokomo. I then got in touch personally with Mr. Haynes, who had been anxious about a supply of cobalt, with the result that he came to Toronto, and Mr. Haynes and the Deloro Smelting and Refining Company linked up together in the development and production of the alloy.

Up to this time cobalt, which had been known for centuries, had been produced mainly in the form of an oxide and used almost exclusively in the ceramic arts. Originally found in Saxony and subsequently in limited quantities in New Caledonia, the large production from the cobalt silver mines flooded the market, and cobalt oxide was at that time unsaleable except in comparatively small quantities. Naturally therefore, any new development that was likely to produce new uses for cobalt would be of interest to the Deloro Smelting and Refining Company, one of the largest producers of cobalt in the world.

On meeting Mr. Haynes I found that he was not only a metallurgist, but an inventor and manufacturer, who had to his credit the production of the first practicable gasoline motor car in the United States, and was then manager of the Haynes Automobile Company, makers of a well-known car.

In his spare time Mr. Haynes devoted himself to metallurgical research, and as a result of numerous experiments he found that cobalt, although apparently similar to nickel, possessed quite different qualities in many ways, and at the time his paper on "Cobalt Alloys" was delivered he had produced an alloy of cobalt and chromium that bade fair to supersede steel for some purposes. This alloy Mr. Haynes called "Stellite," for the reason that when polished it took on a particularly brilliant lustre, hence the name "Stellite."

In addition to its brilliant color, which made it a very attractive looking metal for cutlery purposes, it was stain-proof and rustless. Stellite alloys resist oxidation or tarnishing better than any known metal excepting gold and the metals of the platinum group. It is absolutely immune to all alkaline solutions, and practically so to all chemical salts, including solutions of bichloride of mercury, iodine, etc.

Mr. Haynes states that a stellite bar was subjected to the action of strong, cold hydrochloric acid for thirteen days with a loss of .009 grams. The action of dilute sulphuric acid is slightly more pronounced. Nitric acid has no effect on the metal whatever. Fruit juices and acids do not discolor Stellite, even though allowed to dry on the polished surface.

In point of hardness, the binary alloy, consisting essentially of cobalt and chromium, can be forged with difficulty at a bright red heat, but when it becomes cool, its hardness remains as great as before the first heating. The metal is somewhat stiffer than steel, and notwithstanding its great hardness, it still shows considerable elongation. The alloy can be made in great variety of hardness and toughness, not only by changing the proportion of its constituent metals, but by adding small quantities of other metals. By this means untarnishable alloys can be made which vary in hardness from about that of common, untempered steel, to that of quartz crystal. In fact, one of our Stellite alloys is so hard that it will readily scratch the hardest and toughest steel ever produced. The unique and peculiar properties of Stellite alloys may be summed up in the statement that the alloys combine a greater range of hardness than steel, with the resistance to oxidation of platinum and gold.

The original stellite produced in Kokomo and at Deloro, and intended for cutlery purposes, was found on being tested in Sheffield, England, by cutlers that although the metal possessed many excellent qualities in the way of appearance and freedom from stains, it was so hard as to be—while not entirely unworkable, so nearly so as to be impracticable for the purpose. Mr. Haynes at once set about developing other alloys, and about two years ago produced a stellite used as a metal cutting tool, and this material, manufactured in Kokomo, Indiana, by th

Haynes Stellite Company, and in Canada by the Deloro Smelting & Refining Company, has proven a very great success. It is quite generally in use in the United States, Canada, Great Britain, France and Italy, and there is no doubt that its use in Canada has to a very considerable extent been instrumental in increasing the output of large and small shells in our Canadian factories. The material does not lose its temper even though heated to a white heat, but retains its cutting qualities under these conditions. This makes possible a much greater cutting speed than can be obtained with any other metal, hence the increased output by the use of stellite.

Mr. Haynes has more recently developed a new alloy called Festal Metal, being a combination of stellite and iron, that will shortly be placed on the market for cutlery purposes. This metal has all the non-rusting and non-staining qualities of the original stellite, while it is much more malleable and possesses a greater elasticity than the original alloy. He has further produced a malleable stellite, which is to some extent taking the place of platinum in laboratory appliances, as well as for other purposes.

The present writer not being a technical man, is unable to give other than a general statement of the various stellite alloys and their uses, but the following from a paper recently read by Mr. Haynes, will give a better idea of the nature and character of these alloys.

First, it may be said that these alloys are not fixed or definite in their composition, and may be divided broadly into two classes: (1) those malleable at a red heat; and (2) those which can be worked into the desired form only by casting.

The malleable alloys are composed almost entirely of cobalt and chromium only, though the proportion of the constituents may vary from 10 to 50 per cent. chromium, with a corresponding variation in the cobalt. These alloys are all hard, and while they may be scratched by the file, none of them is practically workable by this means. They cannot be machined, but some of the softest ones may be drilled by means of a hard-carbon steel drill or a drill composed of hard stellite. They resist nitric acid almost perfectly, even when boiling, particularly if the chromium content is over 15 per cent. They forge with difficulty at temperatures ranging from 750 to 1200°C.

They have been forged into the following forms:

(a) Tableware, such as spoons, forks, knives, ladles, etc.

(b) Surgical instruments, pocket knives, dental instruments, etc.

(c) Evaporating dishes, crucible supports, lamp stands, etc.

(d) Jewelry, including finger rings, cuff buttons, scarf pins, etc.

These malleable alloys are all slowly attacked by either hydrochloric, sulfuric, or hydrofluoric acid, but are nearly immune to all chemical combinations, as well as the fruit acids. As the evaporating dishes made of this metal take a bright polish, and can be made of comparatively light section, they will prove suitable for evaporating many chemical salts to dryness, and are particularly suitable for boiling the caustic alkalies. Substances may be evaporated to complete dryness in these vessels without any danger whatever of breaking the vessel, since the tensile strength of the alloy exceeds 100,000 pounds to the square inch, and it also shows considerable elongation before rupture. When a vessel made of this material is struck by a hammer, it emits a clear, musical tone, and continues to vibrate for a considerable length of time. The vessels retain their lustre in the chemical laboratory under practically all conditions, since they are not affected in the slightest degree by sulfuretted hydrogen, ammonium chloride, or other vapors. Furthermore, they are practically immune to acid vapors. They give most excellent results in the form of lamp stands, supporting rings, triangles, etc. When these are heated to full redness, they become covered with a deep blue-black film, which does not change either in weight or appearance by repeated heating, and as no scale ever forms, these articles retain their weight, stability, and smooth surface indefinitely under all sorts of use. They can be subjected to temperatures up to 1200°C., and still retain a considerable amount of strength. In fact, the stellite alloys possess the highest "red hardness" of any of the alloys yet discovered.

While stellite was discovered and developed by an American, the alloy may be considered as distinctly Canadian. All the stellite so far manufactured has been made from Canadian cobalt, and as is generally known, Canada possesses the largest supply of cobalt at present known, and this position will likely be maintained for some time. Until the deposits of this metal at Cobalt were opened up very little incentive existed for research work in this line, owing to the scarcity of the metal and its very high price. Cobalt had for years varied from $4.50 per pound of oxide to $2.50 per pound, which was the price obtaining when the Cobalt camp was opened. The price very quickly dropped to 75 cents, and without sufficient market to absorb the output of the Canadian refineries.

The first alloy of consequence that has so far been discovered is stellite, but no doubt the reasonable price of this metal, and the increasing supply will induce investigations that will disclose new uses and new alloys. One of these new uses is for a light weight metal to replace the household utensils imported hitherto from Hungary.

It may be stated that cobalt is being used to a limited extent in the production of the better grades of high-speed steel.

New Publications

An Elementary Study of Chemistry. By William McPherson and William Edwards Henderson. Professors of Chemistry, Ohio State University. Second Revised Edition. Boston: Ginn and Company. Pp. XII 576.

This book is too well known to require any lengthy review, but a hearty welcome can be extended to this revised edition. The author's attitude towards current chemical theories may be described as being that of advanced conservatives. Perhaps the most outstanding feature of the book is its sanity and balance, qualities which are none too common. There are two features which impress the reviewer unfavorably. One is the great weight of the book, over two pounds. This renders it very fatiguing to hold and, in these days of thin, opaque paper, a drawback of this kind to careful study is quite unnecessary. The second point relates to the spelling. The authors spell sulphur "sulfur," but they spell phosphorus, "phosphorus," thus adding one more anomaly to the language of the United States! J. B. T.

Everyman's Chemistry. By Ellwood Hendrick. 373 pages. $2.00 net. Harper & Brothers, New York. Published in Canada by the Musson Book Company, Toronto.

This book is unusual in that it does not pretend to be a laboratory guide, but is intended to open the door to give the layman a view of the world in which the professional chemist lives and labors. The reader is first introduced into General Chemistry with such a wealth of anecdote and good-natured comment that it is well worthy of perusal if only as a pastime. In a little while, nevertheless, the reader finds himself thinking as chemists think, which is the primary purpose of the work. From this he is led into Inorganic Chemistry with observations on the nature and ways of the different elements and their compounds; then follows Organic Chemistry, which includes a short consideration of coal tar products. The author is well known in New York as one who brings an attractive literary style to the discussion of chemical subjects. His daily articles in the New York Times during the week of the chemical exposition last September interested many who heretofore declared chemistry to be a sealed book.

Applied Chemistry, Progress of. Vol. 1, 1916, being reports issued by the Society of Chemical Industry, Great Britain. Pages 335. Size, 6×8½ cloth; printed for the Society

by Harrison & Sons, St. Martin's Lane, London, printers to the King.

This is the first annual volume published by the Society of Chemical Industry, which has for its purpose a review of the progress made in the various branches of applied chemistry. This volume reviews the progress made in 1916, and as the subject matter is arranged and condensed by specialists in each department the information is of unusual value. The various references are keyed—thus making it possible for the reader to follow the subject at more detail should he desire. The subjects treated in the volume are Fuel; Gas; Mineral Oils; Dyes; Acids, Alkalis and Salts; Glass and Ceramics; Building Materials; Oil Fats and Waxes; Paints,Varnishes and Resins; India Rubber, Leather and Glue; Fermentation Industries; Water Purification and Sanitation; Essential Oils; Photographic Materials and Processes.

Building Stones and Clays. By Charles H. Richardson, Ph.D., 451 pages, 303 copper halftones, 10 zinc etchings, bound in full dark red cloth, gold stamped. Price, $5.50. Weight, 3 pounds plus, postage additional. The Syracuse University Book Store, 303 University Place, Syracuse, N.Y.

This most recent addition to the literature on this subject differs from many other books in that it is primarily a text book devoted to building materials. Although it is a text book, the references are so complete and so well cross-indexed that it may also be termed an index reference book. To architects and engineers engaged in buildings, both large and small, the book will prove of real value as it presents definite information concisely and clearly presented. Granites, Limestones, Sandstones, Slates, Shales, Serpentines, Clays, Bricks are each exhaustively treated, as also are concrete and artificial stones. The twenty pages on paving materials is one of the best concise treatises we have read on this subject.

Report of Ontario Nickel Commission.

The report of the Royal Ontario Nickel Commission, recently issued may well be termed an encyclopedia of nickel, so far as the history and evolution of the industry in Canada in relation to nickel mining in other countries is concerned. It makes a volume of 864 pages, including the large appendix, index and maps. The commissioners, in preparing this report, visited Great Britain, France, Norway, Australia, New Caledonia, Cuba and the United States, and the result is a mass of information dealing with nickel production and the industries specially connected with it. The main conclusions of the commission are that the deposits of Ontario are vastly greater than those yet known in any other country, that the conditions for refining in Canada are favorable, that, of the processes in use the electrolytic will be the most satisfactory; that refining in Ontario will be a great help to the chemical and metallurgical industries of Canada; and that the processes used by the new refineries being built here are up-to-date; and finally that the system of taxation on these mines is equitable. It may be added that the taxes already imposed have more than covered the cost of the commission's world-wide investigations into this important problem. For many years to come this report will constitute one of the most valuable text books on nickel as an industry, and it will remain a monument to the industry and patience of its editor, Thomas W. Gibson, Deputy Minister of Mines, who acted as secretary of the commission.

Inland Revenue Department, Ottawa.

Dr. A. McGill, Chief Analyst, Inland Revenue Department, in this bulletin, entitled "Human Food" has placed the fundamentals of the chemistry of food and nutrition in such an interesting and simple order that everyone may read it with profit. His connection with the office of the Food Controller in an advisory capacity places him in a position to realize, slightly in advance, the initial necessity of facing our tremendous problems relative to national food supplies, in a highly scientific and practical manner. Coming as it does at the present time this is one of the most educative bulletins published by the Government.

The Nickel Industry of Canada

From Data Prepared by the Late D. H. Browne, of the Canadian Copper Company

Although nickel was discovered in 1751, and has been used in the arts since the beginning of the 19th century, it is only within the last few decades that its production has become a distinct factor in the mineral industry of Canada and the United States. Up to 1870 Norway led in the production of nickel ore. In the next two decades New Caledonia produced from two-thirds to three-fourths of the world's supply. From 1890 to the present date the Canadian mines have taken the lead from New Caledonia, and are now producing the greater portion of this metal. How these Canadian ores came to be worked and how the leadership was wrested from New Caledonia, is the subject matter of this paper.

The history of nickel in Canada is curiously interwoven with the history of three men, none of whom was in the beginning aware of the ideas of the others. These men were S. J. Ritchie, of Akron, Ohio; Robert M. Thompson, of New York, and an Englishman named John Gamgee.

In 1876 John Gamgee was in Washington, D.C., endeavoring to interest the United States Government in his proposals for the cure of yellow fever patients in the Southern States. Mr. Gamgee believed that a low temperature was a specific cure for yellow fever. He proposed to build a large hospital ship, in which a low temperature was to be maintained by ice machines, and this ship was to sail around the Gulf ports taking on board yellow fever patients and keeping them at a low temperature until they recovered.

The Navy Department became interested and promised Mr. Gamgee a liberal appropriation for this ship, provided he could work out the mechanical details in a satisfactory manner. A large shop in the Navy Yard was placed at his disposal and work was begun on his ice machine. One of the difficulties he encountered was that at the pressure he employed, ammonia gas leaked through cast iron. While he was experimenting with various alloys he met Mr. S. J. Ritchie, of Akron, who was then in Washington. During their conversations on this problem the use of an alloy similar to meteoric iron was proposed, and a great deal of experimental work was done—melting nickel with iron and steel. As a result of these experiments many of the remarkable properties of nickel steel were discovered, and it was decided to use this alloy in the ice machine. Unfortunately, Gamgee was unable to agree with the appropriation committee, and the whole affair was allowed to lapse. There were no patents taken out by Gamgee for these alloys, and the only result of these experiments was to leave on Mr. Ritchie's mind a strong impression of the value of nickel steel. As Mr. Ritchie was not at that time in any way connected with the nickel industry this seed lay dormant for many years.

About this same time Mr. Robert M. Thompson and his partner, Mr. W. E. C. Eustis, were developing a deposit of nickel ore in the township of Orford, in Quebec. This ore contained small amounts of sulphide and nickel—millerite distributed in a matrix of calcite chrome garnet and pyroxene. Mr. Eustis put up a reverberatory furnace and tried to smelt this ore, but was unsuccessful on account of the refractory nature of the slag. They closed down this mine and transferred their attention to a copper deposit at Capleton, in Quebec, which they were able to mine and smelt without much difficulty. There they made a copper matte, which they sold to Hunt & Douglas, copper

refiners, at Pheonixville, Pa. In order to extend their business they decided to build their own refinery in the States and accordingly built at Constable Hook, N.J., a copper smelter which later took the copper ore from Capleton and finished it to blister copper. This plant was called the Orford Copper Company, after the township of Orford in Quebec. Shortly after the plant was built Mr. Eustis retired from the partnership, taking the Capleton mine as his share of the property and leaving to Mr. Thompson the ownership of the Orford Copper Works at Constable Hook. As Mr. Thompson had no mineral supply he sent agents out to purchase copper ores. Just about this time, 1885, copper was discovered in the Sudbury district of Northern Ontario. So far Mr. Thompson had had no connection with the nickel industry except his early failure to solve the problem of the nickel ore at the Orford Mine in Quebec.

In the year 1882 Mr. S. J. Ritchie became interested with some Cleveland capitalists in the Central Ontario Railway, which was built to open up and develop the iron ores of Hastings County, Ontario. This group of men acquired a large acreage of iron deposits, which, unfortunately, proved too high in sulphur to be of marketable value. In order to extricate his backers from this unpleasant position, Mr. Ritchie proposed to extend this Central Ontario Railway to meet the Canadian Pacific Road, by which move he expected to be able to secure some business in carrying to markets in the United States some of the minerals that had been discovered along the line of the Canadian Pacific Railway. With this intention he visited the Sudbury District in 1885 and found there what appeared to be valuable deposits of high-grade copper ore. He took options on these, returned to Cleveland and organized the Canadian Copper Company, which comprised the same group of capitalists who had a few years before lost heavily in their venture into Hastings County iron ores. The Anglo American Iron Company, Mr. Ritchie's former company, took up some other copper deposits some twenty miles west of the holdings of the Canadian Copper Company. At that time nothing was known of occurrence of nickel in the Sudbury ores. We have now the three threads of the nickel industry coming together and uniting. Mr. Ritchie, with his company ready to sell copper ore, which they did not know contained nickel; Mr. R. M. Thompson, coming forward to buy these ores, supposing them to contain nothing but copper and being himself prejudiced against nickel by his disastrous experience at the Orford Mine; and Mr. Gamgee, who had at this time vanished but had left on Mr. Ritchie's mind an impression destined to have memorable results.

In 1887 the Canadian Copper Company commenced to mine copper ore. This ore was a chalcopyrite containing pyrrhotite and pentlandite. At that time, however, nothing was known about pentlandite and everything in the ore not copper pyrites was classified as iron. In 1887, one hundred and sixty-seven cars of picked copper ore were shipped, part to the Nichols Chemical Works on Long Island, opposite New York on the north, and part to the Orford Copper Works, opposite New York City on the south. It was during the winter of 1887 that nickel was discovered in the Sudbury ores. The Nichols Chemical Company were unable to make refined copper of these ores and turned their shipments over to the Orford Copper Company. This company also experienced the same trouble, an unknown element entering the blister copper, hardening and whitening it and making it worthless. Nickel was discovered to be the interfering element, and a campaign of education was begun to discover how to treat this element. The first problem, on which the life of the two companies depended was to remove this metal, slag it out and leave marketable copper. The second, and by far the less important problem, was how to make nickel and how to make money out of it.

At this time there were three interests in control of the nickel interests, the Societe le Nickel, owned by the Rothschilds, who held the New Caledonia Nickel Mines and had five factories in France, Germany and the United Kingdom. The New Caledonia ores contained five or six per cent. nickel in a gangue of magnesium iron silicate. This ore was brought from New Caledonia smelted with gypsum or alkali waste, giving a nickel iron matte, which was treated with blast in reverberatory furnaces or Bessemer converters till the iron was all slagged off and the pure nickel sulphide was left. This required only roasting and reduction to give a pure metal. The Societe le Nickel practically controlled the nickel trade of the world, which at that date (1887) amounted to less than one thousand tons a year.

In England, the Vivians of Swansea produced a little nickel from the nickel copper ores of Norway. They conducted their business with absolute secrecy, having no patents on record. All that was known of their business was that in some way salt cake was one of the ingredients used.

In the United States, Mr. Joseph Wharton, of Camden, New Jersey, had been making nickel since 1862, using ores from the Lancaster Gap Mine in Pennsylvania. Mr. Wharton used a wet process, dissolving up nickel iron matte in hydrochloric acid, precipitating the iron by lime and separating nickel and cobalt by the old method with bleaching powder. Mr. Wharton's industry had in 1882 been crowded to the wall by the Societe le Nickel, which with its New Caledonia ores was producing more nickel than the world consumed. Mr. Wharton's ore was low grade, about 1½ per cent. nickel, and he could not compete on even terms with the French syndicate. He was working in a small way, dealing more with cobalt oxide and nickel salts than with metallic nickel.

In general it may be said of the nickel business at this time that it was suffering from an over supply and that its control was very lightly held by the French company. When in this condition of the market, a very large supply of ore was thrown into the hands of men who knew absolutely nothing about the technicalities of the business, or the condition of the market, the outlook was at the least, doubtful and discouraging.

At the outset, as we have said, imperative business need drove Thompson to devise some way of slagging or separating this nickel from the copper in the Sudbury ores. He had contracted to receive and the Canadian Copper Company had contracted to deliver, several thousand tons of ore containing about 15 per cent. copper. While he was attempting the solution of this problem his first work was to oxidize the nickel by repeated reverberatory smeltings. In this he was successful and there was tied up in the Orford yard a large amount of nickel copper slags. By this means the Orford Company was enabled to market some of the copper and to keep its contracts. In the meanwhile the problem of nickel was vigorously attacked. The only United States patent on the subject was one issued to Tatro of Hartford, Conn., in 1877. Tatro was dead and his patent had never received any practical application. It consisted in smelting nickel copper ores with a mixture of 30 parts lime and 30 parts fluorspar, 21 parts saltpetre, 10 parts common salt and 9 parts potash, in the proportion of three pecks of the mixture to a ton of ore. The crucible in which this ore was melted with the flux was allowed to cool off partially and the supernatant slag, said to contain the copper and iron was poured off, leaving a nickel matte chilled on the bottom of the crucible. This patent was purchased by the Orford Company for the purpose of investigating its merits. On examination it proved to be based on the solvent action of a molten alkali sulphide on the sulphides of copper and iron. This idea was in line with the fact that Vivian was known to be using an alkali sulphate.

After many months of patient work the Orford Copper Company discovered that if a copper-nickel-iron matte were melted with carbon and an alkali sulphide, two products were given, first, a "top" or lighter upper portion containing the major portion of the copper and iron with some nickel, and the second, a "bottom" or heavier portion containing the major portion

of the nickel with some copper and iron. By repeated re-smeltings of these products with more alkali sulphide a comparatively clean separation could be made, copper soda-iron sulphides going one way and nickel soda sulphide going the other way.

During 1887-1888 the Canadian Copper Company continued shipments of picked copper ore. Their market was limited. Freight was a heavy expense, and so in 1888 it was decided to erect a smelter and ship a nickel-copper matte, which the Orford Copper Company was then ready to receive and which might find a market abroad in competition with New Caledonia ore. The first smelter was erected by Dr. Peters in 1888, and blown in on December 23rd of that year. The furnace building was 35×40 feet, and contained one small Herresshoff furnace, 3 ft. 6 in. by 6 ft. at the tuyeres. The early work on this furance was a series of desperate struggles against environment, ignorance, and prejudice. That it was successful is due to the untiring efforts of the management and the unbounded confidence of the directors of the Canadian Copper Company. In 1889 the company produced 8,450 tons of matte, which contained about 1,600 tons copper and 1,200 tons nickel. This was sold in small lots to Wharton, to Vivian and to Tennant, and in large lots to the Orford Copper Company. As in this year the total nickel production of New Caledonia was only 1,332 tons, it was evident that Canada was producing as much nickel as the world could consume.

In order to create a market for this supply, some new use had to be found for nickel. Luckily for the new industry, in May, 1889, Mr. James Reilly, manager of the Steel Company, of Glasgow, make a report to the Iron and Steel Institute on the properties of nickel steel. Mr. S. J. Ritchie, who recalled his own experience with Gamgee about twelve years before, showed this report to General Tracy, Secretary of the United States Navy. General Tracy appointed Lieutenant Buckingham to investigate this subject and at the same time Sir John A. Macdonald appointed Sir Charles Tupper to look into the matter from a Canadian standpoint. These two gentlemen with the directors of the Canadian Copper Company, made in 1889 an extended visit to the steel works in Europe and the United Kingdom and became thoroughly convinced of the utility of nickel steel. During this visit both the German and French nickel companies made overtures for the complete control of the Sudbury nickel deposits. These overtures were rejected. Lieutenant Buckingham and Sir Charles Tupper both reported to their respective Governments on their return. As a result of this investigation, General Tracy ordered of the Creusot Works in France a nickel steel armor plate and for comparison, of Cammel and Company, a steel plate such as was then used on British armoured vessels. These two plates were tested at the Government proving grounds, at Annapolis, Md., and showed conclusively the superiority of nickel steel armour over any other the world had known. Congress immediately appropriated one million dollars for the purchase of nickel and the industry received the Government support it so urgently needed.

In this year, 1890-91, several other companies had entered the Sudbury district. The Vivians had acquired the Murray mine, had built a smelter and were shipping matte to Swansea. The Dominion Mineral Company opened the Blezard mine and started a smelter about 1890. Half a dozen smaller concerns purchased property and started mining. About this time the French Nickel Syndicate reduced the price of nickel to 1s. 1d. per pound. The smaller organizations could no longer operate with profit. The Canadian Copper Company had at one time over 9,000 tons matte stored in their smelter yard. The banks refused to accept their overdrafts and it was only the individual action of the directors who pledged their private fortunes to this enterprise that tided the company over these difficulties. The Canadian Copper Company, organized in 1886, paid no dividends till 1894, at which time the use of nickel steel armour plate had reached such a safe basis that they were able to declare a dividend of eight per cent.

All this time the Canadian Copper Company was simply mining ore and making matte which it sold in the open market. It had no process of its own. The Orford Copper Company, owning no mines, but possessing a valuable asset in the Orford process, was its chief customer. Wharton, of Camden, was also a purchaser of nickel matte. In order to be independent of outsiders the Canadian Copper Company, in 1890, entered the field of experiment to find if possible a process suitable to its own requirements.

M. Jules Garnier, who in 1867 had discovered the New Caledonia ores and who had erected nickel refineries in France to treat these ores, was engaged, and given carte blanche. Garnier erected a Bessemer plant at Copper Cliff to free the matte from iron and erected at Cleveland, Ohio, a plant to make this refined matte into metal and also to treat the Orford nickel oxide and make from it pure shot nickel. Garnier worked on this problem for two years and was at last obliged to give up the endeavor. After his departure Dr. Carl Hoepfner was engaged to work out his electrolytic method of separation of nickel from copper. Dr. Hoepfner built a refining plant in Cleveland and worked about a year at this process without commercial success. After he left the Canadian Copper Company he was engaged by Canadian capitalists and formed the Hoepfner Refining Company with a capital of $10,000,000. He built a large refinery at Hamilton, Ont., but after costly experimenting was obliged to confess failure and the plant was abandoned.

During the year 1897 to 1898, the Canadian Copper Company had its representatives in England investigating the Mond process, on which it had an option. After careful examination it was decided that the Mond process, beautiful as it was, was not adapted to a Canadian climate and environments and the matter was dropped. It took the Mond Nickel Company several years of experimenting to work out the difficulties of their process and place it on a strictly commercial basis.

From 1898 to 1902 the Canadian Copper Company carried on a long and costly series of experiments in Cleveland. They succeeded in working out an electrolytic process which ran satisfactorily. After the International Nickel Company was formed, it was found that no electrolytic process could compete with the Orford process and so this electrolytic work was abandoned.

During the period from 1889 to 1899 the plant of the Canadian Copper Company had been growing unit by unit until it contained seven Herreshoff furnaces and was producing about 3,000 tons of copper and 3,500 tons of nickel in the form of a 35 per cent. matte.

In 1899 another smelting plant on the same lines was built also containing six or seven Herreshoff furnaces. This produced matte up to 1904, in which year the new smelter was built. In 1903 the production had risen to about 3,000 tons of copper and 6,000 tons of nickel.

In the year 1902 the International Nickel Company was organized. It took in the Canadian Copper Company, miners and smelters of ores; the Anglo-American Iron Company, which besides its holdings in Hastings County iron fields, owned some valuable nickel mines, about twenty miles west of Sudbury; the Orford Copper Company, nickel and copper refiners at Constable Hook, New Jersey; the American Nickel Company; Mr. Wharton's refining plants at Camden, N.J., and the Nickel Corporation of London and the Societe Miniere Caledonienne, both of which concerns owned valuable nickel deposits in New Caledonia. This organization brought miners, smelters and refiners to mutual understanding and made the way for many economies that could not heretofore have been effected. The strong competitors of the International Nickel Company are the old Societe le Nickel in France, with its New Caledonia ore deposits and its five refineries at strategic points in England,

France and Germany, and the Mond Nickel Company, with its mines and smelter some twenty miles west of Sudbury and its refinery at Clydach in Wales.

One of the first moves of the International Nickel Company was the gathering of the scattered furnaces of the Canadian Copper Company into one modern smelting plant. This new smelter was built at Copper Cliff in 1903-4, and was blown in in July, 1904. It contained two blast furnaces and three converter stands. This smelter was modelled after the best copper smelting plants in the United States and to this close resemblance were due many of the difficulties which were found in its operation.

It took two or three years of arduous and continuous labor and study to eliminate from this smelter those features of copper smelting which were not adapted to the requirements of copper nickel ores.

As it stands to-day the Canadian Copper Company's smelting plant contains five blast furnaces 4 feet by 17 feet at the tuyeres, and ten converter stands with converters 84 inches by 110 inches. At the present time one basic converter 12 feet diameter and 37 feet long is being installed, and a reverberatory plant containing two modern reverberatory furnaces, 19 feet by 112 feet, is in process of erection.

In this plant, the Canadian Company is producing some 7,000 tons copper and 15,000 tons of nickel a year, in the form of a Bessemer matte containing 80 per cent. copper nickel. This matte enters the United States duty free and is refined at the Orford Copper Company's plant at Constable Hook, New Jersey, where the necessary salt cake, oil, fuel, coal and chemicals can be obtained at figures very much below their cost in Canada, and where also ocean freights and competing railway connections reduce the cost of shipment to a minimum.

NOTE.—The above figures prepared by Mr. Brown refer to the year 1911. The history will be carried down to the present date by Mr. Mathewson in next issue.

Growth of Canada's Exports

The unrevised statement of Canadian trade for the past year shows that Canada has made pronounced gains in the export of chemicals, explosives, etc. The following are the values:

Exports from Canada	1916	1917
Drugs, dyes, chemicals	1,222,592	1,823,350
Electric apparatus	573,044	1,357,824
Munitions	73,904,586	240,302,414
Explosives	7,080,926	40,917,856
Gasoline engines	85,641	133,673
Machinery	1,522,579	2,260,714
Pig iron	307,721	343,906
Wire and wire nails	4,483,263	9,038,143
Total iron and steel and manufacturing of	54,483,597	49,065,299
Plumbago, manufactures of	141,348	352,906
Paints and varnishes	349,298	962,988
Paper	20,039,550	26,123,215
Sugar, etc	313,684	3,931,933
Wood pulp	10,376,548	20,404,053
Manufactures of wood	11,497,870	21,378,798

Calendars Received

Messrs. Merck & Company, chemical manufacturers, New York and Montreal, have prepared for their friends a novelty for office use, in the form of a card about 9×14 inches, combining a memorandum docket and a calendar for the first six months of 1918.

The British Aluminium Company, Front Street W., Toronto, have published a photographic reproduction of their large dam at Kinlochleven, Scotland, with a calendar having for its motto this extract from King George's address to the Army: "I have implicit confidence in you, my soldiers. Duty is your watchword and I know your duty will be nobly done."

A Plea for Canadian Chemists - Also a Warning

By A. F. G. Cadenhead

Three incidents having no immediate connection with one another and from widely separated sources have occurred within the last few months.

These should prove not only interesting to, but should command the serious attention of chemists individually, and of the chemical profession as a whole—if indeed there be, in reality, and not merely in name, a chemical profession as compared with say, the medical or the legal professions; a fact which is open to much question at the present time.

By the individual "Chemist" I refer to the university graduate in chemistry. A man who has spent four or five years in college in the attainment of a degree, and a year or two or three as the case may be, in post-graduate work in research in pure or applied chemistry. The majority of such men in the natural course of events, at this stage, go into the control or research departments of our varied industrial and government laboratories.

Taking these events in the order of their occurrence, the first is one which will no doubt be recalled with amusement by many. At the time when the order was issued from militia headquarters at Ottawa, in the early spring of 1916, stating that no more chemists were to be attested for overseas service, and that those at that time enlisted in the C.E.F. were to be retained in Canada; an officer—a major if memory serves me—of one of the overseas units stationed at Niagara Camp, was approached by a reporter for the Toronto Globe, with a request for further information regarding this order. This officer replied that he had no knowledge of the order, and indeed, so far as he knew, there was an ample supply of "dispensers" in the army.

The incident was reported at some length in an issue of the Toronto Globe, of February or March, 1916, under a heading to the effect: "Chemists Not to be Retained in the Country—No More Dispensers Needed in the Army." Even the reporter was apparently unconscious of being facetious.

The second incident was the appearance in the Journal of Industrial and Engineering Chemistry,* of an editorial headed, "Status of Chemists in Hospital Units."

The editor quotes, in part, from a correspondent dated July 17th, 1917, and which on account of its significance is reproduced here. The correspondent writes:

"I had just been granted the degree of Ph.D. in chemistry from one of our leading universities, and was desirous of serving in a capacity most useful to my country. At this time the chief of a large hospital unit then in course of organization for service in France, called up the head of our chemical department, requesting a chemist for the unit, specifying a Ph.D. man capable of tackling any original problem that might arise at the base. The faculty selected me to see the physician in charge. In short, I was asked if I was a Ph.D., whether I had done any original research, and whether I would accompany the unit as chemist—one of the enlisted men. My question as to a commission was met with the reply that 'only physicians and dentists were given commissions,' but the possibility was mentioned that I might be offered a civilian appointment at fifty dollars a month."

Dr. ———— goes on to say that he was in a position to do good work with this unit; his qualifications having included bacteriology and a six years' experience in health department laboratory work. He naturally turned down the proposition for two reasons: (1) Financial. The money spent on his course having been borrowed; (2) offering enlistment with "orderlies, cooks and barbers," he felt to be insulting to the dignity of the profession. He writes not in a spirit of complaint, but to present the facts—"in the event that it should become advis-

able later for chemists to seek recognition."

The third refers to a part of the presidential address delivered before the American Chemical Society, September 12, 1917, at Boston.*

The president, Dr. Julius Stieglitz, of the University of Chicago, is one to whom we may well listen with respect, and whose words should have a profound significance for all connected in any way with chemistry, no matter from what standpoint they view it.

In this excellent address, Dr. Stieglitz makes a plea for more adequate recognition of the services of the chemist by his employer. He says—in part:

"Turning first to the field of applied chemistry, I would like to emphasize that in my opinion the most important single factor which could lead to a tremendous increase in power in our industrial development is not immediately a question of scientific achievement, but a factor found in a simple psychological analysis of our industrial situation. Let our manufacturers but awaken to the great significance, to the full meaning of the simple old behest that the laborer is worthy of his hire, and they will be astounded at the results. American manufacturers at present on the whole do not treat their chemists, and specially their research and directing chemists, fairly. The tendency is to exploit the chemist as an employee, instead of treating him as a partner who brings scientific experience, skill and acumen to the aid of capital and commercial experience and standing. Manufacturers are willing to cooperate essentially on the footing of partners with great lawyers, who solve their legal difficulties—usually a wholly sterile performance as far as the welfare of the nation as a whole is concerned—but they have not learned to cooperate in the same fashion with men of our profession, who solve their technical difficulties to the direct enhancement of the nation's wealth and welfare! Our chemists know and feel that they are being exploited and in conscious or unconscious resentment, after one bitter disappointment or the other in their employers' fairness, they lose their fresh enthusiasm and their capacity for the whole-hearted, unstinting effort that goes with work in which the heart and soul support the mind! All this is wrong. Research and managing chemists should be sure that success means partnership in the fruits of their success, that success will yield immediately and not in some hazy future of a soon forgotten promise, an equitable share in the actual benefits of the work done. This is one of the real but unrecognized sources of the unquestioned leadership of Germany in fields chemical."

Dr. Stieglitz states that for over fifteen years the largest of the many great German firms have been guaranteeing to their employees, from the lowliest workman to the highest chemist, by contract, a royalty,—a definite share in the money earned or saved by any suggestion or discovery on the part of the individual.

Contrast this policy with the situation in the great majority of American plants—with the form of agreement outlined elsewhere in this article. Dr. Stieglitz gives a concrete example of this American attitude, and one which is by no means an isolated case. "A Ph.D., of the University of Chicago, chief chemist for one of the very largest concerns in the country—a unit in a 'Trust'—perfected a device simple in itself that saved the corporation perhaps $80,000 per year. His reward was a princely increase of $200 or $300 a year in salary."

As Napoleon caused every soldier to feel that he carried a Marshal's baton in his knapsack, so our manufacturers should let their chemists feel that each one carries in his brains a contract of partnership, and all that is involved therein. The adoption of such a policy on the part of capital toward workers would bring in the "Dawn of an era of power and prosperity in our industries in which no one need fear the after-the-war competition for which all Europe is now preparing."

Unrecognized—Underpaid

The significance of these incidents is obvious. Two bare facts facing us are these:

First: Chemists are not recognized in the business and industrial world as are members of other professions. While, indeed, our information in this case deals with conditions in the United States, I will venture the statement that the same thing is true in Canada even to a greater extent.

Second: Due to this lack of recognition, chemists are subject to conditions unfavorable to their best efforts, and this in spite of the fact that their function is as vital to the welfare, physical and economic, of the nation as that of other professions; and more so than some.

Chemists are familiar with the document which is presented for signature upon entering the employ of some industrial concerns.

In this document, "In consideration of the sum of one dollar paid by the employer to the employee, and receipt of which is hereby acknowledged," etc., etc., the employee—that is, the chemist, agrees that all ideas, inventions, discoveries, patents, etc., of which he may be guilty during the term of his employment with the company, belong wholly to the company, and with no mention, and in many cases no intention of compensation.

Is this a good policy on the part of business which employs chemists? Does it not react unfavorably against both employer and employee, giving the latter the feeling that he is being robbed of the just fruits of his labors, and so deadening his enthusiasm and initiative, of which, in turn, the employer is deprived?

If in the concrete example furnished by Dr. Stieglitz we work out in percentage the proportion of profit granted the man who perfected the device, we find that he received actually about one-third of one per cent. of its value to his employer—certainly a poor stimulus toward more work of the sort.

An independent inventor submitting a similar idea to a capitalist for its development, and successfully proving its worth, would be morally right in claiming forty-nine per cent.

Also the chemist is largely underpaid. Here again we are forced to seek our facts in the United States—and the reference to Canada still holds stronger than ever.

A paragraph from the summary of a lengthy article by Mr. Breithut, below referenced, may be profitably quoted.

Referring to the total number of chemists employed by the United States Government, and the State and City of New York, he says:

"If we adopt $3,000 or more per annum as a fair measure of the 'successful' chemist, we find the following:

	Below $3,000	$3,000 or over	Total
Number..........	727	88	815
Per cent..........	89.2	10.8	100

And if we can place the cause of this failure to appreciate the chemist can we suggest a cure?

In Touch With the Public

It is due in part at least to the chemist himself. In very rare cases only will the blood of a chemist be found to contain the serum of the bacillus advertisus. He is too busy in his laboratory where he finds more than enough to occupy his attention. It is not in his nature to go about explaining in terms comprehensible to the everyday world what he is doing. He is essentially a technical man, and his subject has not heretofore been a popular subject.

Robert Kennedy Duncan in his "Chemistry of Commerce" and Dr. Geoffrey Martin, in his "Wonders of Modern Chemistry" have perhaps done more to popularize this branch of

* J. Ind. and Eng. Chem. Aug. 1917, pp. 731.

† Vide J.A.C.S., Vol. 39, No. 10 (Oct. 1917), pp. 2095.

‡ J. Ind. & Eng. Chem., Jan. 1917, pp. 64. "The Status and Compensation of the Chemist in the Public Service." F. E. Breithut.

science than any others in a like way. I know that the executive business staff of at least one large industrial concern from the president almost to the invoice clerks, sat up nights, absorbed in reading the latter works. In this connection too, it is pleasing to note that the chemical expositions now being held annually in the United States are attracting much more general attention. But the people at large are hardly beginning to be aware of the significance of the subject.

Better Organization

One of the chiefest causes, however, is the absolute lack of organization of any kind among Canadian chemists. We simply do not know ourselves as a class, and indeed beyond our particular friends, as individuals either.

Until there is some unity of purpose behind the movement, it is foolish to entertain hopes of bettering conditions. Obviously the chemist must seek recognition—must advertise himself and his doings. Very surely no one else will perform this distasteful duty for him. It is distinctly up to the profession backed by its members to discover the most effective and if they will serve, the least ostentatious methods of attaining to this.

A Minister of Science Needed

There are Ministers of Finance, Ministers of Lands, Forests and Mines, Ministers of Agriculture—why not a Minister of Science—essentially a scientist—with a portfolio divorced from politics and independent of parties? At the present time of preparation for the industrial war which will inevitably follow the present struggle of arms, can anyone venture to estimate the value to the country of having a man with the intimate knowledge of the issues at stake with our chemical industries alone, among its law makers?

In the United States, the American Chemical Society is marshalling the chemists into forces which will be a strong factor in the future prosperity of the country.

In Canada we have a firmly established branch of the Society of Chemical Industry, of which too few Canadian chemists are members. Cannot they do something for us, and we for them? It would appear that there is a large service in this respect alone that they could render to the Empire.

With something of this end in view a meeting was held in Montreal last April under the auspices of the Society of Chemical Industry. It served to bring together many chemical men in and about Montreal, but since then nothing has been heard from that quarter. And until the great majority of Canadian chemists get behind this thing, nothing will be done.

The medical profession needs no advertising. At some time or another the doctor goes into every home in the land. His merciful function is recognized and appreciated by the lowest and the highest alike. The lawyer likewise, is at the command of the crook and the corporation, and his services are duly appreciated—and paid for.

But the chemist—who spends just as much time and money in preparing himself for his life's work, and whose function is of equal if not paramount importance to the economic and industrial life of the nation at the present time in particular—would appear to be in need of organization comparable to that of an army in the field; and of advertisement as wide as that of a popular brand of chewing-gum—which he undoubtedly helped to perfect—so that the nature and significance of his work be adequately understood and appreciated by the country at large.

Shawinigan Falls, January, 1918.

Outstanding Minerals of Canada

In an address before the Canadian Club of Montreal A. A. Cole, president of the Canadian Mining Institute, dealt with Canada's mineral resources. Mr. Cole summarized in a few striking sentences some of Canada's outstanding minerals.

"Our coal resources are among the greatest in the world.

"Our asbestos deposits in the Eastern townships of the Province of Quebec supply most of the asbestos of commerce.

"The greatest nickel deposits in the world are located at Sudbury.

"Ontario has the largest body of high grade talc on the continent at Madoc; the largest body of high grade feldspar on the continent in the Richardson mine near Verona; the greatest mica mine on the continent at Sydenham and the greatest graphite mine at Calabogie.

"During 1916 also a molybdenite property was discovered within twenty-five miles of Ottawa that bids fair to outstrip all rivals.

"The tar sand deposits of Northern Alberta are the most extensive in the world.

"We also have one of the richest silver camps in the world at Cobalt, and the most promising of the younger gold camps on the continent at Porcupine.

"Our smelters at Deloro and Thorold also produce more refined cobalt than all the other refineries in the world put together."

Prohibited Exports from Canada

By proclamation of the Governor-in-Council the exportation to the United Kingdom and British possessions of the following goods is prohibited in addition to articles already named.

Soya bean oil, copra oil, oleo oil and lard substitutes, starch, sugar (except to members of oversea forces under regulations), glucose, corn oil, syrups, molasses, peanut oil, palm and olive oil, oleomargarine, condensed milk.

Licenses may, however, be issued permitting exports under authority of the Minister of Customs.

By proclamation of the President the United States Government takes power to restrict or prohibit the following articles: Antimony, asbestos, arsenic and its compounds; acetic acid, glacial acetic acid; acetate of cellulose and all acetates; animal oils; caustic soda; cinchona bark; gutta-percha; iridium; iron and steel wire rope, cable and strands consisting of six or more wires; mica, mica splittings; methyl-ethyl ketone; opium; quebracho extracts; strontium ores; soda ash; soya bean meal; soya bean oil; shellac; surgical instruments; titanium; vegetable oils, wolframite; wood alcohol.

Licenses have to be obtained for such exports; and imports of the following items are also controlled by the United States Government in the same way:Antimony, antimony ore, or any chemical extracted therefrom; asbestos; beans of all kinds; balata; burlap; castor seed,castor oil; cotton; chrome, chrome ore, or any ferro-alloy or chemical extracted therefrom; cocoanut oil; cobalt, cobalt ore, or any ferro-alloy or chemical extracted therefrom; copra; industrial diamonds; all ferro-alloys; flax; gutta joolatong; gutta-percha; gutta-siak; hemp; hides and skins; jute; iridium; leather; managanese, manganese ore, or any ferro-alloy or chemical extracted therefrom; mica; molybdenum, molybdenum ore, or any ferro-alloy or chemical extracted therefrom; naxos emery and naxos emery ore; nickel, nickel ore, matte, or any ferro-alloy or chemical extracted therefrom; sodium, potassium, or calcium nitrates; optical glasses; palm oil; platinum; plumbago; pyrities; rice; rubber, raw, reclaimed, waste or scrap; scheelite; shellac; sisal; soya bean oil; spiegeleisen; sugars; tanning materials; tin in bars, blocks, pigs, or grain or granulated; tin ore and tin concentrate, or any chemical extracted therefrom; titanium, titanium ore, or any ferro-alloy or chemical extracted therefrom; tobacco; tungsten, tungsten ore, or any ferro-alloy or chemical extracted therefrom; vanadium, vanadium ore, or any ferro-alloy or chemical extracted therefrom; wheat and wheat flour; wolframite; wool.

Canadian Chemical Industries Created by the War

(From the Toronto Globe's Annual Review, by a Representative of The Canadian Chemical Journal)

Since the war broke out money to the amount of $400,000,000 has been put into the chemical industries of the United States, and in Canada somewhat more than $100,000,000 has been embarked in chemical works, if we include certain metallurgical works whose products enter into chemistry in a special way.

As in the case of a man whose deafness or blindness has been cured by the shock of an exploding shell, Canada has been shocked into a comprehension of what the future holds for her in the chemical and metallurgical industries. The electrolytic production of chemicals and metals is one of the industrial changes whose effects on the physical world will grow with time and increasing knowledge, and no one who understands the ramifications of chemistry into every other art, science and industry can fail to see that with the present remarkable start Canada must ultimately be a leader in electro-chemistry. This must be evident from the fact that while, according to the latest official figures, the developed water powers of Canada make an aggregate of 1,712,193 horse power, the undeveloped powers that have been roughly measured amount to 17,746,000 horse power, and this total leaves out of reckoning the powers in the great stretches of unexplored land in the northern regions of Canada. Thus Canada not only has a vaster aggregate of unutilized hydraulic power than any country in the world, but within her borders are larger deposits of many of those minerals which are essential to the chemical industries. Nickel, cobalt and molybdenum are examples, where the deposits already proved so far outrank other countries that Canada may almost be said to have a monopoly.

The chemical products that are now being turned out in Canada, that were never considered possible before the war would make quite a catalogue, and every month one or more enterprising manufacturers start some new industry. No longer do the owners of coking plants allow the vapor from their works to go to waste, but they are turning it into benzol and toluol, and from these two products they make aniline oil, nitro-benzol and nitro-toluol.

Acetic acids, acetates and acetones are rapidly developing as Canadian industries; bi-chromate of soda and other chrome products are made in high quality, and steps are being taken to turn Canadian barytes into barium sulphate and peroxide, for which there would be an export market. The calcium carbide industry, in which Canada was in reality the pioneer, has received a remarkable impetus, though the present prices, due to transportation obstacles, hampers the business. Calcium carbide is also being turned into acetone at the rate of four tons a day in one of the Canadian works.

A few of the pharmaceutical chemicals now being made in Canada are asperin, resorcin, benzoate of soda, benzoic acid, salvarsan and other products more or less monopolized by German manufacturers before the war.

The large deposits of magnesite in the Ottawa region have been very successfully exploited since the war, and not only is the Canadian product furnishing the material for the star-shells which the Canadian troops are using at the front, but the metallic magnesium, which had been a German and Austrian monopoly, is now made at Shawinigan Falls in a higher degree of purity—that is, 99.75 per cent. and over—than has yet been achieved by European manufacturers. This will be important after the war, because tests have been made which show that Canadian metallic magnesium can be used in alloy with other metals largely used in making household utensils in substitution of aluminium, and can be made as well here as in Hungary.

Before the war cobalt had become a drug on the market, but, thanks to the patient investigations of men like Professor Kirkpatrick, cobalt has suddenly found a market in the production of stellite—a wonderful tool-cutting metal, which retains its efficiency even after becoming red-hot—and, still more important, cobalt alloys are already likely to rival nickel as a plating metal, and for other purposes. Since the Canadian deposits of cobalt-silver are so vast, compared with other countries, it is only necessary that a few capable capitalists should come forward to build up in Canada a round of industries based on cobalt as the raw material which will equal, perhaps surpass those of Hungary and Germany. We should also note that a by-product of these cobalt ores is proving very helpful now as the material for "dryers" in paint factories and color works.

Referring again to our undeveloped water power, Canadians who have an idea that our present enemies have an insurmountable advantage in the production of nitrates from their relations with Chile should be reminded that the electrical problem involved in recovering nitrogen from the air has already been solved. Starting in 1905, the commercial production of nitrates in Norway, for instance, grew until when the war began that country was devoting about 250,000 hydro-electric horse power to nitric acid, etc., in competition with Germany and other countries, and this year Norway is using 500,000 horse power for this purpose. The first works in America for the fixation of nitrogen is located in Canada, at Niagara Falls, where it is applied to the making of cyanamide. Its present production is 64,000 tons per year, which is exported to the United States to be converted into a new kind of fertilizer to which the manufacturers give the name of Ammo-phos.

The War-Born Twins of Industrial Canada*

The great war has been as the breaking up of the fountains of the great deep in the industrial history of Canada. This is true not only in the sense that new industries have been created that were never thought possible either in Canada or the United States; but these new developments are surely leading to others that are going to divert the trend of our industrial life into a new channel, as some vast upheaval of land turns the channel of a river into another country.

Before the war the textile, paper, pulp, leather, wood-working and many other industries of Canada struggled into positions of more or less national importance, and it was generally thought that such success as they achieved in their competition with foreign manufactureres was largely due to the advantage they had in the importation of cheap chemicals, dyeing materials and colors, most of which were admitted free from European countries, especially Germany and Austria. Bearing this in mind, what high-tariff enthusiast would have formulated, or what Government working under the party system would have had the courage to endorse, a tariff designed to build from the foundation up a complete round of chemical and metallurgical industries? Yet the miracle has already been accomplished, and Bill Blockade and Bill Contraband have proved a mightier industry builder to Canada than Tariff Bill.

After the stocks of chemicals in neutral countries had been exhausted, which occurred within a few months of the outbreak of war, Great Britain and her Dominions, as well as the United States, realized that this war must be won by the chemist and metallurgist, and that the chemical and metallurgical industries had to be co-ordinated till the allied nations could be self-sustaining in the essential chemicals at least. In spite of predictions that this could not be achieved within ten or twenty years, Great Britain, Canada and the United States are to-day supplying their own needs, and are, moreover, helping their allies with munitions, explosives and ordnance. No figures are available from Great Britain, but at the middle of last year it was estimated that more than $400,000,000 had been embarked in new chemical industries in the United States, while in Canada $100,000,000 had been invested in chemical works and in metal-

*From an article in "Industrial Canada," contributed by a member of the staff of the *Canadian Chemical Journal*.

lurgical works specifically related to war chemicals. Every month new chemical and metallurgical works are being established in Canada and the United States, and those who best understand our national problems now realize that these industries must be made permanent, since they are as essential for the national safety in peace as in war time.

Take for example some of the ramifications of the fixation of nitrogen from the air. There is a popular impression that in nitrogen, as well as the potash industry, Germany has a world-monopoly. This was true in a sense in the nitrogen industry; but the fact is that the natural nitrate deposits of Chili, from which Germany drew, are no longer available to German industry; that the Chilean deposits are now nearing exhaustion and becoming more expensive to extract; and further, that, even before the war, the hydro-electric method of producing atmospheric nitrogen was revolutionizing many chemical industries. For instance, Norway, starting in a small way in 1905, had developed this industry until in 1914 a total of 250,000 electric horse power was devoted to that industry, while this year Norway is using 500,000 horse power in fixing nitrogen. A large part of this output has been going to Germany, and the shortage caused there by cutting off Chili is made up by devoting both steam and hydro-electric power to this method of fixing nitrogen in German establishments.

The fixation of nitrogen as an industry is of immediate importance in war, seeing that this is the source of nitric acid and ammonia and other chemicals produced by reactions from these; but how much more important is the process in peace. Not only do these chemicals enter into the production of paper, textiles and scores of other industries, but the restoration of our depleted soils depends more upon nitrates than any other fertilizing compound. It is not merely Canada which needs nitrogen and its compounds, but the whole world, and since its production depends primarily on cheap water power, Canada and not Chili is the destined main source of nitrates, nitric acid, ammonia, etc. Out of a total of about 19,000,000 horse power, roughly measured in the more or less explored regions of Canada, less than one-tenth, or 1,712,000 horse power has been brought into harness. This is the measure of the productive capacity of Canada in electro-chemistry, and if this were all applied to nitrogen and its compounds the whole world would not need to look for any source but Canada. Realizing the imperative need of replacing Germany as a source of nitrogen, the United States appointed a commission of experts to advise on a policy, and, acting on the commission's report, Congress at its last session appropriated $20,000,000 with which to begin nationally-controlled fixation works. Of this sum $4,000,000 was allotted for works operated by steam and not electric power. This was because a steam plant could be put in operation more quickly than a hydro-electric plant, economy of operation being a secondary consideration. But the main aim has not been lost to sight, and within the last month the United States Government has started thousands of hands at work on an immense electric-power plant for the fixation of nitrogen, located on the Tennessee river, and to cost $50,000,000.

The situation on this side of the Atlantic is that Canada has the only hydro-electric nitrogen fixation plant now in actual operation in America. It is located at Niagara Falls, Ont., and the fixed nitrogen is converted into cyanamid, and the cyanamid all exported to the United States to the extent of 64,000 tons per annum, the output having doubled since the war began. The owners are an American company, who take the Canadian product to a subsidiary plant near New York and make most of it into a new brand of fertilizer. This situation raises the question: What steps are the Canadian Government taking to secure the early production of the chemicals based upon nitrogen, which, as already shown, are of paramount national importance? So far no official move has been announced. Because of the time required to develop the works, because also of the large volume of power required, and the urgency of the need of nitrates, etc., after the war, the present delay will have serious consequences for Canadian agriculture and Canadian industries in common. These consequences will be serious when peace comes, and still more serious if the war is prolonged. On account of the high cost of developing the large amount of power for such work, it would seem a case for national action, rather than by private capital.

Recent Incorporations

Great Lakes Steel Corporations, Owen Sound, Ont., capital, $1,000,000; names mentioned: F. Regan, W. N. Irwin and E. J. Murphy.

Eugene F. Phillips Electrical Works, Montreal, $4,000,000; F. B. Common, F. G. Bush, G. R. Drennan, M. J. O'Brien.

Electric Smelting Company, Brantford, Ont., $45,000. A. Goodwin, H. M. McIntyre, J. Ker, P. H. Secord and others.

British Explosives, Ottawa, Ont., $50,000. D. M. McLean, F. E. Westergaard, A. C. E. Owen, John McMillan and A. L. Spaffard. To make explosives, chemicals, fertilizers and acids.

Imperial Oil, Toronto, $50,000,000. W. C. Teagle, C. O. Stillman, G. W. Mayer. The company takes power to make or deal in metals, oils, chemicals, salt, wood products, etc.

Pacific Galvanizing Company, Vancouver, B.C., $10,000.

Standard Engineering Company, Victoria, B.C., $10,000.

Lead Products, Vancouver, B.C., $100,000.

Nickel Lake Mining Company, Limited, (no personal liability), $1,000,000. A. A. Macdonald, E. M. Miller, K. Donahue.

Dominion Metallurgical Company, Toronto, $250,000. H. A. Harrison, W. M. Cox, W. N. Robertson.

Pyrene Manufacturing Company of Canada, Montreal, $100,000. J. A. Miller, A. H. Elder, M. C. Lalonde.

Bancroft Mining Company, Montreal, $100,000; G. W. MacDougall, L. Macfarlane, W. B. Scott.

Union Colleries, Montreal, $1,000,000. E. M. McDougall, L. G. Bell, S. C. Demers, J. B. Henderson. To acquire the coal lands of the Dominion Coal Company in liquidation, situated in Alberta.

Great West Coal Company, Winnipeg, $2,000,000. Edw. Spice, H. E. Swift, R. W. Campbell, C. J. McLeod, H. V. Hudson.

Aluminium and Calcium Alloy

For an alloy of aluminium and calcium, unusual properties are claimed, according to the Scientific American. By combining about eight to ten per cent. of calcium with about ninety per cent. of aluminium, an alloy is obtained which is claimed to be lighter than aluminium itself and to possess machining properties excelling aluminium or any of its other alloys. It is suggested as especially valuable in the manufacture of light castings for automobiles or airships. Such castings should have low specific gravity, good machining properties, and freedom from brittleness; they should be capable of taking the finest impressions from the mold. The new alloy is said to fulfil all these conditions.

In the ordinary aluminium castings it is customary to introduce a hardener such as copper, tin or zinc, aluminium itself being too soft to machine or cast properly. But hardeners increase the weight, tend to cause brittleness and in some cases the resulting alloys are less resistant to corrosion. The new aluminium-calcium alloy is from five to twenty per cent. lighter than aluminium or its ordinary alloys; is much harder and more resistant to corrosion, and machines easily. The calcium also acts as a purifier and prevents the formation of oxide while the castings are being made.

This alloy cannot be made by simple fusion of the mixed metals because calcium itself burns, even when heated at a low temperature. To make the alloy, calcium in small pieces is pushed under the surface of the melted aluminium and held there until melted.

The Nitrogen Problem

By Frank S. Washburn*

Without fixed nitrogen the earth would soon become an uninhabitable desert waste. Sir William Crookes, the English chemist and economist, declared that the food supply of the world is dependent upon the supply of nitrogen. It is absolutely necessary to the existence of animal and plant life. We live in it, we breathe it, we eat it, and it enters into the composition of the human body. Nitrogen is a constituent of all organized life and tissues. In a free state it is a colorless, tasteless, odorless, gaseous, nonmetalic element. The atmosphere enveloping the globe consists chiefly of nitrogen, which constitutes 78 per cent. of its volume and 75.5 per cent. of its weight. It has been estimated that the column of air resting upon each square yard of the earth's surface contains 6.4 net tons of nitrogen. The material is abundant; in fact, it is unlimited; but as Dr. Thomas H. Norton has said, "The nitrogen problem of the day is the difficulty to bring it into a form available for the wants of mankind."

The atmospheric nitrogen above 1 square mile of land, amounting to about 20,000,000 tons, is equivalent to what the world will require in the next fifty years at the present rate of consumption. Of this enormous reserve a minute fraction—about 0.000002—is in the active service of the vegetable and animal kingdoms. In the soil, in the form of nitrate, it is a chief factor of plant food. From the plants it passes into the bodies of animals, whence it returns to the soil. Through the action of bacteria, with the aid of certain legumes, and by electrical discharges in the air, a corresponding amount is constantly brought into a combined form and enters the cycle of changes. The amount of this "nomadic" nitrogen, as it has aptly been termed, is on an average of about three-fourths of an ounce for each square yard of land.

The actual consumption of nitrogen in its cruder forms in the United States in 1910 was 283,496,000 pounds, valued at approximately $45,000,000 (wholesale), of which more than $32,000,000 worth was imported.

In the United States the per capita consumption is at present only a little over one-half that for Germany. It is, however, rapidly growing, and the annual sum now sent abroad for the purpose of nitrogenous compounds has become even a more important item. The fact that the United States, in common with all civilized countries, and especially with all agricultural and manufacturing countries, is dependent upon the one natural source of nitrate in Chile, and the additional fact that the Chilean nitrate deposits are not particularly extensive and are destined at an early date to complete exhaustion, constitute another factor in the nitrogen problem.

The efforts that are being made to release the manufacturing and agricultural interests of the world from this dependence assume increasing importance each day in many European countries. During 1913 the United States imported 625,000 tons of Chilean nitrate, valued at $21,630,000, upon which the Chilean export duty was 60 per cent. Thus the people of the United States paid taxes to the Chilean Government of $8,000,000 for part of the nitrogen they consumed.

Increasing Demand for Fixed Nitrogen

Dr. Norton, in his monograph on the "Utilization of Atmospheric Nitrogen," says:

"During the middle of the nineteenth century a disturbing force came into play as the result of the increase of population in those countries where cereal foods are a staple element of diet, especially in Europe and North America. The methods provided by nature for maintaining a certain normal degree of fertility were no longer adequate in order to insure a sufficient supply of wheat and other cereals in various countries. In order to increase the yield of a given area of land, recourse was had to artificial fertilizers. The needed nitrogen was obtained partly from the ammonia secured as a by-product in the manufacture of gas, to some extent from accumulated deposits of guano, and largely from the remarkable deposits of sodium nitrate in Chile. For over half a century the consumption of both ammonium compounds and sodium nitrate has increased constantly. In addition to the demands of agriculture, modern chemistry calls for vast amounts of nitric acid and its derivatives. One-fifth of the Chilean nitrate now consumed in Europe goes into the manufacture of explosives, of coal-tar colors, and of other allied products."

In 1898 Sir William Crookes estimated that the bread eaters of Europe and America numbered 516,000,000, and were increasing at the rate of 6,000,000 annually. The acreage of cereals in that year was 167,000,000, and only 100,000,000 acres more were available for such cultivation. The annual per capital consumption of wheat was 4.6 bushels and the average yield per acre was 12.8 bushels. From these figures he calculated that by 1941 the wheat fields of the world must cover 292,000,000 acres in order to meet the demands of a population of 819,000,000 bread eaters. During the period from 1900 to 1910 the population of the United States increased 21 per cent., but crop production increased only 10 per cent. Taking Germany as a good example of European agricultural practice, she has in twenty years increased her yield of grain crops fifteen bushels to the acre, as compared with only three bushels for the United States. Her potato crop has been increased 80 bushels, compared with 24 bushels for this country. In general, German acre yields are approximately 80 per cent. greater than for the corresponding crops in this country, and yet Germany has only one-fourth the acreage under cultivation that the United States has.

Professor H. Erdman compiled the following data from German experiments to show how easily the productivity of German farms could be still further increased:

(From Soil Improvement Committee Bulletin, National Fertilizer Association)

Crops	Present Acreage	Average Crop per Acre Tons	Possible Crop by Intensive Culture Tons	Nitrogen to add Per Acre Pounds	Additional Crop Obtained Tons
Rye......	15,000,000	0.60	1.20	52.8	9,000,000
Wheat...	6,000,000	.75	1.60	114.4	4,800,000
Oats.....	10,000,000	.69	1.52	88.0	8,000,000
Potatoes..	8,000,000	5.20	12.00	105.6	40,000,000
Barley...	2,500,000	.66	1.40	52.8	1,500,000

These proposed additions of nitrogen are supplementary to the quantities already employed in German agriculture to the extent of an average of 50 pounds per acre. To show the correctness of the figures advanced by Prof. Erdman, the following table illustrates the role actually played by nitrogen in the cereal production of Europe, using the average figures of crop yields for the period from 1903 to 1907:

Countries	Wheat	Rye	Barley	Oats	Nitrogen Applied Per Acre
	Tons	Tons	Tons	Tons	Pounds
Germany...	0.848	0.652	0.760	1.880	50.0
Austria.....	.492	.500	.548	.400	26.0
Hungary...	.480	.460	.504	.452	24.0
France.....	.584	.456	1.000	1.000	31.0
Belgium ...	1.040	.720	....	2.464	58.0
Portugal....	.300	....	....	....	3.5
Italy.......	.352	.360	....	.328	....

It is conceded by eminent authorities that an adequate supply of nitrogenous fertilizer, along with modern methods of intensive agriculture, will easily increase the yield of farm products per acre to such an extent that the present food problem of civilization can be advanced far into the next century.

Use of Fertilizers Well Established

The history of the use of fertilizers has proved without a doubt that they have an essential and economic place in good agriculture. Within the last twenty years Germany has increased her crop production over 61 per cent., and one of her leading authorities, Professor Wohltman, predicts that within the next twenty years there will be an additional increase of 40 per cent. The Germans say that this increase has been brought about by a better knowledge of how to till the soil and how to use fertilizers. When American farmers take up the same methods with the same thoroughness, and not until then, will our yields be raised to the same high levels.

There is a great difference in the yield of staple crops produced in Germany, where fertilizers have been used for the last one hundred years, compared with the same crops grown in the five Northeastern States of this country, where fertilizers have been used for a period of at least a half century, and compared with the same crops grown in the five Central States, where fertilizers are just beginning to be accorded their logical place in good farming, as shown by the following table:

Average Yield Per Acre for 1910-1912, Inclusive
(United States Census Report for 1910)

	Wheat	Oats	Potatoes
Germany (fertilizers used over 100 years)	31.3	51.0	186.3
Five Northeastern States—Maine, New Hampshire, Vermont, Massachusetts, New York (fertilizers used for the last half century or more)	23.9	36.6	134.5
Five Central States—Illinois, Iowa, Ohio, Indiana, Missouri (States that have used fertilizers less than 25 years)	14.5	34.4	79.5

The official German crop returns, issued by the German imperial statistical office, report that in 1912 there was an increase of 38 per cent. in the crop production of that country over the production of 1911. It is interesting to note that in 1910 Germany used 6,000,000 tons of fertilizer, while in 1900 she was using only half that quantity. In 1912 American farmers, upon four times the area of land cultivated, used only 6,500,000 tons of fertilizers. To be more exact, Germany applied 145 pounds of fertilizer per cultivated acre, while the Eastern States applied 67 pounds per cultivated acre, and the Middle West corn belt States applied only 8 pounds per cultivated acre. Undoubtedly the addition of plant food in this shape is responsible to a very large degree for the larger yields of superior quality obtained across the sea.

Importance of Nitrogenous Fertilizers

The three chief elements of plant nutrition are nitrogen, phosphorous, and potash. Nitrogen is the most important and costly element of fertility. As a fertilizer nitrogen produces more immediate and direct effects than application of phosphoric acid and potash alone. The nitrogen in many fertilizer mixtures costs more than the phosphoric acid and potash together, but it produces the greatest crop increase, especially in complete mixtures. This is illustrated by the following average yields obtained in tests covering 55 years at the Rothamsted (England) Experiment Station.

	Wheat Bushels	Straw Pounds
No fertilizer	12.9	1,175
Phosphate and potash only	14.8	1,380
Nitrogen only	20.5	2,090
Complete fertilizer	31.6	3,570

It is the forms of nitrogen that account for the varying results obtained with different brands of fertilizers of the same analysis. Phosphoric acid and potash salts are alike in grade, but there are about twenty different forms of nitrogen in common use. Some are excellent, some are fairly good, and some are almost worthless.

[Concluded in next issue]

Society of Chemical Industry

Ottawa Branch

A meeting of the Ottawa Branch of the Society of Chemical Industry was held on December 13th in the Carnegie Library, pursuant to a notice. About forty-five members and their guests were present. T. H. Wardleworth, chairman, presided. The secretary reported on behalf of the Committee on Organization, that it had been decided to proceed with the formation of an Ottawa Branch of the Canadian Section.

The chairman asked for nominations to the committee for the session. Messrs. Shutt, McGill, Babington, Stansfield, Connor, Maclaughlan, and Race were nominated and declared elected.

The meeting was then addressed by Professor Ruttan, of McGill University, on the subject of "Industrial Research."

An interesting discussion followed in which Drs. McGill and Shutt, and Messrs. Stansfield, Connor, Hambly and Race took part. On motion of Mr. Wardleworth a vote of thanks was passed to Dr. Ruttan for his inspiring address.

After the meeting, Mr. Tustin, of the Food Controller's office, spoke to the members on the subject of "Municipal Domestic Waste," and asked the members of the Ottawa Branch to take the question under advisement.

Joseph Race, F.I.C.,
428 Slater Street, Ottawa. Secretary.

Montreal Section

The second meeting of the Montreal Section, Society of Chemical Industry, was held at the Canada Club, December 14th. The chair was occupied by Mr. Wardleworth, and there were eighteen members present.

Upon the chairman calling for reports on miscellaneous business, Mr. Gragaroff expressed the opinion that something should be done to define more clearly the status of technical chemists in Canada.

Mr. DeCew said the lack of appreciation of the function and importance of the technical chemist had led to confusion and unfairness in connection with military service exemptions. He thought the society should make some recommendation to Government conveying a caution against depleting the various industries of technically trained men.

The secretary reported that such a resolution was already being prepared.

Notice of motion was given of a resolution to adopt a standard method of water analysis.

The chairman then called on B. F. Haanel, of the Mines Branch, Ottawa, to read a paper on the "Utilization of Our Peat Resources." Mr. Haanel, after referring to the serious situation which Canada faces in the matter of fuel supply, particularly in the central provinces, called attention to the vast resources of fuel which lie unused in our peat bogs; and although in the past there have been several unsuccessful attempts to start a peat industry, there was no reason why such an industry should not flourish in Ontario and Quebec. He showed from data based on European practice and on experiments carried out by the Department of Mines, that natural drying by wind and sun is feasible, and when scientifically managed, is economical. Good results with peat have been obtained in domestic stoves, but the utilization of peat will be best effected in central heating and power plants using gas producers. The recovery of by-products and of ammonia in particular will do much to yield profits; but profits are now irrelevant since it is imperative that Canada should develop her own fuel resources and not depend on foreign supplies, which may be unobtainable in a few years, so far as coal is concerned.

Dr. Stansfield, Professor Goodwin and Mr. Archer took part in the discussion which followed.

The chairman, in conveying the society's appreciation of Mr. Haanel's paper, said the Government should be urged to realize the need for action in a problem of such serious import.

A. F. Robertson,
36 St. Gabriel Street, Montreal. Resident Secretary.

Toronto Section

A meeting of the Toronto Section of the Society of Chemical Industry was held at the Engineers' Club, 92 King Street West, on the evening of December 21st., S. B. Chadsey, presiding.

After formal business Mr. Chadsey called upon E. P. Mathewson, of the British America Nickel Corporation, to read a paper on the history and recent developments in the nickel industry. The paper was in two sections, the first section consisting of a sketch of the early history of the nickel industry in Canada and the United States by the late Mr. Browne, an official of the Canadian Copper Company. In the second section the history is continued from 1910 down almost to the present time. The first section is reproduced in another part of this issue. The paper was illustrated by a number of lantern slides and a number of points were lucidly explained by Mr. Mathewson in answer to questions.

A hearty vote of thanks was passed to the lecturer.

The question of the effect of the military service tribunal decisions on the work of trained chemists was briefly discussed.

Mr. Davies, of the Standard Chemical Company, said the problem was a perplexing one, and the difficulties of the Government claimed our sympathy, no matter how inconsistent the decisions of the various judges might be, when compared with one another. Any memorial on the subject should be carefully drawn up with a view to giving aid to the authorities in deciding what men should be exempt. By such counsel and assistance the men most essential to the efficiency of our chemical industries would be retained without loss or friction.

The chairman, Professor Bain, Mr. McDougall and others agreed in this, and on motion of Mr. Davies it was decided that a motion already prepared on the subject should be referred to a committee with the view of drafting a memorial on the subject.

A motion by Professor J. W. Bain, on the standardization of methods of water analysis was, on the suggestion of Mr. Crossley, deferred for further investigation.

A paper by Alfred Tingle, D.Sc., of Ottawa, on "Acidimetry of Colored Liquids," was presented by Dr. Ardagh on behalf of the author.

The secretary reported for the information of the meeting a proposal to hold a general convention of the chemists of Canada at Ottawa on the occasion of the annual meeting of the Ottawa Section some time in April. He asked the members to consider the matter with a view to some action at the next meeting.

A meeting of the Toronto Section was held on January 18th, Mr. Chadsey in the chair. There was a large attendance, among those present from out of town being Dr. A. McGill, of the Inland Revenue Department, Ottawa, Dean Goodwin, of Queen's University, Kingston, and M. W. Pirrie, Director of Explosives, Imperial Munitions Board.

A motion for accepting the methods of Joseph Race, F.I.C., Ottawa, as the standard for water analysis, was adopted.

A memorial to the Government on the subject of military service and the chemists, was reported by the committee to whom it was referred, and it was decided to refer the text to the other Sections for approval before presentation to Government.

In the discussion on this subject Dean Goodwin expressed the hope that third and fourth year students who had volunteered might be returned to service in chemistry.

Mr. Pirrie, of the Munitions Board, said that on his representations orders had been issued that no chemist was to be enlisted in the British forces, but this programme was changed, and now that contracts with the explosives companies had expired, a new problem was before them. He had suggested that chemists should be enrolled under the ordnance corps, so that if they were wanted for industrial chemistry they could be transferred. In this crisis we must chiefly look to students to fill the depleted ranks of chemists. There was also another hope in the services of women. After visiting the munitions and chemical plants in England he had become an advocate of the employment of women. In one establishment there were 17,000 hands, of whom all but 3,000 were women. In one chemical works a nitrator started fuming and the impending explosion was avoided by the courage and presence of mind of the women who, instead of leaving as advised by the men in charge, set to work to cool off the apparatus. There was no limit to the valuable work women could do; and while it was hardly fair to ask women to work in some acid plants, the chief problem was that of proper housing.

Dean Goodwin said that up till two years ago there were no women in the chemistry department of Queen's University, but now there are about half a dozen and there was a tendency among women students to take that course.

Professor Bain said there were no women in chemistry in Toronto University, but a number in arts and possibly a maximum of twenty-five could be got and trained for industrial work in six months or less.

Mr. Schorman, of the British American Oil Company, was not able to give his promised paper on petroleum, having been detained in the United States, but in his place Dr. A. McGill gave an instructive talk on gasoline. In the days when coal oil was used for illuminating purposes only the Canadian regulations defined the term gasoline (a term first used in 1880) very vaguely, and over a dozen petroleum products were then classed as gasoline. The internal combustion engine made a revolution in the uses of petroleum and the lower hydro-carbons have been more valued. Again a gasoline that would give good results in a stationary engine will not do for a motor. For these and other reasons, a clearer legal definition is needed. It is the user of gasoline—not the consumer of coal oil—who now needs the protection of the law.

Mr. McDougall, of the Toronto Power Company, and Professor Bain, referred to some of the problems that come up in the cracking processes in oil.

After the meeting closed a committee meeting was held at which the proposal for a convention of Canadian chemists in Ottawa was warmly approved. As the university work would not be closed in April, it was suggested that a better time would be the latter part of May, coinciding, if possible, with the annual meeting of the Royal Society of Canada, to be held in Ottawa.

Alfred Burton,
114 Bedford Road, Toronto. Secretary.

Manitoba Chemical Society

A second meeting of those interested in an organization for Manitoba chemists was held on Friday, December 21st, in the University of Manitoba. Seventeen chemists were present.

The committee appointed to consider organization submitted its report which embodied information it had obtained regarding the following matters: (1) Organization as a branch of the Canadian Section of the Society of Chemical Industry. (2) Organization as a branch of the American Chemical Society. (3) Organization as a provincial society.

In regard to the Societies mentioned in 1 and 2, the committee had obtained facts in regard to fees and privileges and had ascertained that each has about the same number of members in Canada. Expressions of opinion solicited from representative chemists in different parts of Canada had been of a most contradictory character. In view of these facts, the committee unanimously recommended that, for the present, the organization take the form of a provincial society to be known as "The Manitoba Chemical Society." This recommendation was unanimously approved by the meeting.

A constitution was then drawn up and adopted. This constitution is based on that of the "Scientific Club of Winnipeg," which, founded in 1905, has been notably successful. There is no president, the chairman for each meeting being the reader of the paper at the previous meeting. The officers consist of a secretary, a treasurer and a committee of four.

Members of the following societies may become members of this organization on payment of the membership fee: (1) Society of Chemical Industry; (2) Chemical Society of London; (3) American Chemical Society; (4) American Electrochemical Society.

Other members may be elected. The Society has already a membership of over twenty, fairly representative of the educational institutions, the industrial laboratories and bureaus and the manufacturers of the province.

At the next meeting of the Society, officers will be elected and Professor Parker will deliver an address.

The secretary of the society is Professor H. S. Davis, lecturer on chemistry, University of Manitoba, Winnipeg.

A meeting of the newly organized Chemical Society was held in the Science Building, of the University of Manitoba, on January 15th. The organization of the Society was completed by the election of the following officers: J. W. Shipley, secretary; E. L. C. Forster, treasurer; committee—Professor M. A. Parker, Dr. T. J. Birchard, Dr. H. S. Davis, Mr. F. Pugh.

Professor Parker gave an interesting address concerning the development of Chemical Industry, dwelling largely upon the interdependence of scientific investigation, and the industrial arts and manufactures. Professor Parker also gave a short synopsis of the work of the Advisory Council in Canada.

Further meetings of the Society will be held on February 12th, March 12 and April 19th.

McGill University has a chemical society, which is doing good work. It holds fortnightly meetings, at which reports of original research or reviews of current chemical literature are presented. The subjects at forthcoming meetings are: February 1st, "The Chemical Control of Respiration"; February 15th, "Atomic Structure and Valence"; March 1st, "Molecular Phenomena in Solids and Liquids"; March 15th, "Pernicious Vomiting."

At the next meeting of the Toronto Section of the American Institute of Electrical Engineers, on Feb. 1st, Professor A. P. Coleman, of the University of Toronto, will give an address. C. R. Dooley, of the Westinghouse Company, East Pittsburgh, is to give a paper on "Technical Education in an Engineering Works," on February 15th, whilst two weeks later R. P. Jackson, also of Pittsburgh, will address the section on the subject of "Commercial and Industrial Research."

Personals.

James G. Parmalee, research metallurgist for the Granby Consolidated Mining and Smelting Company at Anyox, B.C. has accepted a fellowship in metallurgy at the University of Idaho, Moscow, Idaho.

Colonel Thos. L. Livermore, for twenty-one years vice-president of the Calumet & Hecla Mining Company, and connected with other copper companies, died at Boston, January 9th.

Lieut. John S. Galbraith, who has been awarded the Military Cross, is a son of the late Dr. John Galbraith, Dean of the Faculty of Applied Science, University of Toronto. Lieut. Galbraith was for a time on the staff of applied science in the university.

E. F. Wood has resigned as first vice-president of the International Nickel Company, and R C. Stanley, general superintendent of the Bayonne works has been elected to succeed him.

Industrial News Items

The business of Commercial Chemicals, Limited, manufacturers of benzoic acid, Toronto, is being wound up.

Montreal Cotton Company's mill at Valleyfield, Que., was damaged by fire at a loss of $100,000.

Store houses of the Simcoe, Ont., Wool Stock Company, were recently destroyed by fire. Loss, $25,000; supposed cause, incendiarism.

On January 6th the plant of the Pittsburgh and Des Moines Steel Company, Chatham, Ont., was damaged to the extent of $8,000 by fire resulting from two explosions.

The Empire Pulp and Paper Company has started its mill at Ocean Falls, B.C. In addition to newsprint it will manufacture manila wrapping and kraft paper.

The Martin-Senour Company, Limited, paint and varnish manufacturers, of Montreal, are establishing a plant in Vancouver, having leased premises at 1505 Powell Street.—Industrial Progress.

Owing to the extremely cold weather and other causes the new blast furnace at Sault Ste. Marie, Ont., has not been completed, but will be blown in by April next.

The Algoma Steel Corporation has thirty new coke ovens under construction being five more than at first planned. This brings the total of its coke ovens up to one hundred and forty.

The Skeena Coal Company, of British Columbia, held its annual meeting recently at the head office, Quebec. J. G. Scott was elected president; Alex. Gauvreau, vice-president; and Alex. Hardy, secretary. The company controls 30,000 acres of coal lands north of Prince Rupert, the coal resembling the anthracite coal of Pennsylvania, and the smokeless Welsh coal.

Owing to a breakdown in the water chlorination plant at Hull, Que., there is an outbreak of typhoid fever in that city and law suits are threatened owing to the failure of the council to carry out the order of the provincial board of health to build a mechanical filtration plant.

The Gas Journal of Canada reports that a casinghead gasoline plant will be established in the Viking field of Northern Alberta, where a considerable gas production has been developed by the Northern Alberta Natural Gas and Development Company. The casinghead proposition is backed by Montreal capitalists, who expect to commence work next spring.

Efforts are being made to increase the production of natural gas in Southern Ontario. The Dominion Natural Gas Company have brought in a new million-feet mill at Port Burwell, and the Sterling Gas Company have started two wells of the same capacity in Sherbrooke township. At the same time there is a shortage of gas in many towns between the Niagara and the Detroit, owing to the increased demand for industrial purposes.

S. J. Johnstone, one of the experts of the Scientific and Technical Research Department of the Imperial Institute, London, recently gave a lecture on the rarer Key minerals. The minerals considered were those containing tungsten, thorium, molybdenum, platinum, tantalum, and zirconium. These minerals are essential to such trades as the manufacture of armour and high-speed tool steel, incandescent mantles, automatic cigar lighters, filaments for electric lamps, and furnace linings. The British Empire contains large supplies of most of the minerals, and makes important contributions to the world's production. Although their utilization was largely left to Germany before the war, considerable progress has since been made in their use in this country. It is understood that the lecture will shortly be issued in pamphlet form by the London School of Economics.

New Chemical Company

Among the new chemical industries started within the last two months in Ontario is the Acme Laboratories, Limited, of Toronto. This company has offices at 263 and 265 Yonge Street, with factory and laboratory at 132 Richmond Street West. The company has specialized on chemical sprays for fruit growers and florists, among these specialties being arsenate of lime, lime-sulphur solution, sulphate of nicotine, bordeaux mixture, and nicotine, kerosene and sulphur soaps. The president of the company is Dr. J. F. Strangard, and H. V. Jansen, vice-president. Mr. Jansen is a chemical engineer with several years' experience in Sweden, in the Nobel Company's works near Stockholm. He has also had experience in Canada in the Dominion Explosives Company works and at the Canadian Nobel works.

Some of the electro-chemical plants using Niagara power at Welland and neighboring towns, have been hampered by shortage of current, and the Hydro Electric Power Commission appeals for economy in the use of electricity, till the new supply of power is available from the new Chippewa plant. On the American side of the Niagara river the United States Government has ordered that power be diverted from non-essential industries in favor of the electro-chemical plants working on war orders. Meantime the United States engineering staff is working on a plan to increase the hydraulic power on the American side by a canal taking water from the Niagara at La Salle and carrying it through a tunnel to Lewiston where turbines and generators will be installed to generate 20,000 horse power at the start, this to be increased to 1,000,000 horse power.

Contracts to the Shawinigan Electro Metals Company from the British Government for production of chemicals have been extended to cover the year 1918. The Shawinigan Water & Power Company have extended their power plant at a cost of about $1,800,000.

A large amount of chrome is being mined in Richmond county, Quebec, though the ore is of lower grade than that of the now exhausted mine at Thetford. Two concentrating plants owned by the Mutual Chemical Company, of Canada, have a daily capacity of 50 tons of concentrates. A new mill of 15 stamps has been erected by Joseph Belanger, of Black Lake. The price of chromite is now the highest on record, and has advanced considerably over 1916 values. Present quotations for ore f.o.b. Thetford, Blake Lake or Coleraine range from $21, for 25 per cent. sexquioxide to $64 for 50 per cent. (concentrates) per ton of 2,240 pounds and the demand exceeds the supply.

The Consolidated Mining & Smelting Company, of British Columbia, made a record last year in the production of 10,000 tons of pure zinc valued at $3,000,000. Its production of lead was 22,000 tons, an increase of 2,000 tons over 1916. It produced metals to the value of $13,000,000 and doubled its output of sulphuric acid. J. J. Warren, the managing director, is on a visit to Montreal regarding the future operations of the company.

Fred. W. Field, editor of "The Monetary Times" since 1906, has been appointed British Trade Commissioner for Ontario, with headquarters in Toronto. No man in Canada is better qualified for the post, either by knowledge of trade conditions in Canada and Great Britain or by geniality and integrity of character. Unofficially and unobtrusively he has already done much to promote Canadian trade with Britain and the other Dominions, but a greater field is now opened for public service by Mr. Field's present appointment.

David Watson, of the wholesale drug firm of D. Watson & Company, formerly Kerry, Watson & Company, Montreal, died January 15th. Mr. Watson was born in Arbroath, Scotland, and had lived in Canada sixty-two years.

H. R. MacMillan, formerly chief forester for British Columbia, and more recently assistant manager of the Victoria Lumber Company, Chemainus, is now working with the Imperial Munitions Board. He is investigating the possibilities of British Columbia spruce for airplane manufacture, and Major Austin Taylor, of Montreal, has been appointed director of aeronautic supplies of British Columbia.—Industrial Progress.

Reference has been made to the projects for manufacturing potash from kelp obtained on the sea coast of British Columbia. We understand that the Potash and Algin Company, whose plant is at Sydney, on Vancouver Island, produced a quantity of ash last year, the product being sold as fertilizer. This company has now been reorganized under the name of the Canadian Kelp Products Company, and recently installed a "harvester" capable of producing thirty to forty tons of kelp a day. They are now obtaining four or five tons of ash, using rotary kilns. This product, which on analysis gave 21 per cent. of K_2O, is being put on the market in tins for fertilizing purposes. It is reported that the other kelp potash firm, the International Chemical Company, which has been selling shares, is also to be reorganized. The promoters of the original company are understood to be chiefly Seattle men, among whom are Messrs. Von Alvinsleven, Imhoff and Dernberger.

J. B. Tyrell has been nominated as next president of the Canadian Mining Institute. E. P. Mathewson is re-elected as a vice-president, and H. E. T. Haultain, of Toronto, and J. A. Dresser, of Montreal, nominated to replace Messrs. Fergie and Gibson as vice-presidents. Among the papers prepared for the next annual meeting is one on oil flotation in the United States by R. C. Canby, a well known metallurgist, and another on the "War Minerals Commission of the United States," by A. G. Kirby, metallurgist, of Salt Lake City.

W. J. Dick, mining engineer, reporting to the Commission of Conservation, on the briquetting of Western coals, estimates the cost of laying briquettes down in Winnipeg at $10.50 per ton, or a little more than the present cost of anthracite. The cost would be less than anthracite in towns farther west, and if anthracite increases the difference would be greater in favor of briquettes.

The name of the Canadian Society of Civil Engineers is to be changed to "The Engineering Institute of Canada." The present membership of the society is 3,090.

Before the war the United States imports of dyes amounted to $10,000,000 a year in anilines alone; but the growth of dye manufacturing has been such that the exports of various dyes from the United States will amount to over $15,000,000 for 1917.

Japan recently held an exposition of Chemical Industries. It was patronized by the Emperor and Empress and was a great success. Japan now has about fifty works making dyestuffs and intermediates, besides a number of acid and explosives factories.

A new alloy, developed at Nelson, British Columbia, is being put on the market. It is called Canadium and is a composition composed of 70 parts tungsten and 30 parts chromium, annealed. The Franklin Chemical Company, Limited, London, England, are reported to be the selling agents.

Chemical and Metal Markets

The Quotations below represent average prices for the quantities indicated. Larger quantities may be obtained at lower figures.

TORONTO, January 24, 1918.

Shortage of coal, shortage of engines and cars to transport it, shortage of coke and shortage of many other materials due to these shortages, combine to make prices and supplies uncertain in the chemical and metal markets. So far even the enforced five-day closures of factories in the United States has not given relief from these conditions, though the near approach of spring with lessening domestic requirements in coal will soon begin to count.

Oils and materials entering into paints and colors are firm, lead and zinc oxides having advanced, while prices for glue and glue stock are at a higher level than for years. Meanwhile Washington is calling on the paint and varnish makers to cut down the shades and simplify the requirements of such products as are not needed for war. Twelve of such industries have volunteered to change their methods in such a way as to save 20,000,000 tons of coal this year.

The crude oil problem is acute in Canada as well as the United States. The diminishing production of the Southwestern Ontario fields is being investigated by a commission, but in the United States a bill is being passed in Congress for the government operation of new oil fields under an Oil Administrator. New fields will be systematically explored and it is hoped the supply will be increased. The severe weather is reducing production in the Eastern States, with the consequence that Pennsylvania crude has gone up to $3.75 a barrel, and this is causing advances in gas, fuel oil and kerosene, but not in gasoline.

Potassium nitrate, potassium salts and all potash and nitrogen products are hard to be got and prices must be taken for the moment as only nominal. This is owing to the difficulty of getting United States government licenses. Sodium silicate is hard to get owing to scarcity of soda ash. Carbolic acid and benzoic acid continue to go up in price. Ammonia and ammonia products are dear and likely to be dearer. Grain alcohol has advanced 50 cents a gallon.

The metal markets are unsettled owing to the effects of the license system in the United States, and the railway shipping difficulties. The United States Government has extended the Government price of 23½ cents for copper a pound till next June. The war industries consume over half the production of copper, while the demand from abroad increases. The output of the Cobalt mines for the calendar year 1917 is about 21,000 tons of cobalt, which exceeds the highest previous record of 1914, when it was 18,200 tons. Prices are steady.

Inorganic Chemicals

Alum, lump ammonia	100 Lbs.	$5.50—6.00
Aluminium Sulphate, high grade, bags	100 Lbs.	3.00
Ammonium Carbonate	Lb.	.14
Aqua Ammonia .880	Lb.	.11
Bleaching Powder, 35% drums	100 Lbs.	3.50
Borax, crystals	Lb.	.09½—.10
Boric Acid, powdered	Lb.	.17
Calcium Chloride, fused, in drums	Lb.	.2½
Caustic Soda, ground, Bbl	Lb.	.09—.10
China Clay, imported	per ton	$25—$30
Cobalt Oxide, black	Lb.	1.50—1.75
Copper Sulphate (Blue Vitriol)	Lb.	.11—.12
Fuller's Earth, powdered	100 Lbs.	6.00
Hydrochloric Acid, carboys, 18°	Lb.	.03¼—.03¾
Lead Acetate, white crystals	Lb.	.20
Lead Nitrate	Lb.	.18—.20
Magnesium Carbonate, B.P., brl	Lb.	.14—.15
Nitric Acid, 36° carboys	100 Lbs.	9¼—9¾
Phosphoric Acid, S.G. 1750	Lb.	.75
Potassium Bichromate	Lb.	.60
Potassium Bromide	Lb.	1.75—2.00
Potassium Carbonate 90 to 95%	Lb.	.85
Potassium Chlorate, crystals, Kegs	Lb.	.90
Potassium Nitrate......, Kegs		(Nominal)
Potassium Permanganate, bulk	Lb.	4.00
Silver Nitrate	Oz.	.80—.85
Soda Ash, bags	Lb.	.04
Sodium Acetate	Lb.	.15—.20
Sodium Bicarbonate, 100% pure	100 Lbs.	3.75—4.00
Sodium Bichromate, bbls,	Lb.	.03
Sodium Cyanide, bulk, 98-99 per cent, in cases	Lb.	$ .45
Sodium Hyposulphite, kegs	100 Lbs.	2.75
Sodium Nitrate, refined	100 Lbs.	8.00
Sodium Silicate, according to density	100 Lbs.	2.50—3.75
Sulphur, ground	100 Lbs.	4.50—5.00
Sulphur, roll	100 Lbs.	4.00—4.50
Sulphuric Acid, 66°Be, carboys	100 Lbs.	3.25
Tin Chloride, crystals	Lb.	.70
Zinc Sulphate, com	Lb.	.6½

Organic Chemicals

Acetanilid, C.P.	Lb.	1.10—1.20
Acetic acid, commercial, crude, 28%, in bbls.	Lb.	.7⅞—.8½
" " 80 per cent. pure	Lb.	.29—.33
Acetone	Lb.	.41—.43½
Alcohol, methylated, bbl	Gal.	1.60
Alcohol, grain, bbl	Gal.	7.50
Alcohol, wood, 95 per cent., refined	Gal.	1.55
Aspirin (acetyl salicylic acid)	Lb.	4.50
Benzoic Acid	Lb.	5.00—6.00
Carbolic Acid, white crystals	Lb.	.85—.95
Carbon Bisulphide	Lb.	.10—.15
Chloroform, com	Lb.	.75—.90
Citric Acid, domestic, crystals	Lb.	.85—.90
Glycerine, 56 lb. tin	Lb.	.80
Oxalic Acid	Lb.	55
Salicylic Acid	Lb.	1.25—1.50
Tannic Acid, commercial	Lb.	1.40—1.50
Tartaric Acid, crystals or powdered	Lb.	.80—.90

Metals

Aluminium, No. 1, 98-99%	Lb.	.38
Arsenic, white	Lb.	.15
Antimony	Lb.	.18—.19
Brass, yellow ingots	Lb.	.18—.20
" red	Lb.	.25
Cobalt, metal	Lb.	2.25
Copper, casting	Lb.	.32
Copper, electrolytic	Lb.	.33
" Am. Government price (electrolytic and casting	Lb.	.23½
Iron, bars	Lb	.05½—.06
Lead	Lb.	.09
Magnesium	Lb.	2.50
Mercury	Lb.	1.50—2.00
Nickel, electrolytic	Lb.	.50—.55
Platinum, pure	Oz.	105.00
Silver	Oz.	.87—.90
Spelter	Lb.	.10
Steel, sheet, 28 gauge	Lb.	.08—.09
" mild	100 Lbs	5.50
" nickel, in bars	Lb.	.25
Tin	Lb.	.75—.81
Zinc, sheet	Lb.	.25—.30

Index of Advertisements

Canada's Metal Output, 1917

The Department of Mines estimates the production of metals from Canadian ores in 1917 as follows:

Gold, $17,000,000; silver, 23,500,000 ounces; copper, 113,000,000 pounds; nickel, 84,800,000 pounds; lead, 56,000,000 pounds; zinc, 31,000,000.

The production of pig-iron was about 1,186,000 short tons, and steel ingots and direct steel castings 1,735,000 short tons.

The production of coal was about 14,100,000 short tons.

The production of gold, silver, copper and coal was less than in 1916. The production of nickel, lead, zinc, pig-iron and steel was greater than during the previous year.

Higher prices derived for silver, coal and other products considerably enhanced the total value of the mineral production. It is estimated to have been not less than $200,000,000, as compared with $177,201,534, in 1916.

Lately the Quebec magnesite industry has taken an important step forward. The two principal operators, the North American Magnesite Company, and the Scottish Canadian Magnesite Company, are now making dead-burned magnesite, containing a suitable percentage of iron, for furance lining. The magnesite is being burned in the cement kilns of the Canada Cement Company, at Longue Point, near Montreal, and at Hull, near Ottawa. The product is very satisfactory and widely used. The North American Magnesite Company has obtained a lease on a promising property in Harrington township, and a gang of men is at work mining magnesite and storing it, awaiting winter roads to haul it to the railway.—Canadian Mining Journal.

Precipitates and Concentrates

At the beginning of 1918 the American Chemical Society had a membership of 10,603. Outside of this membership there are 5,000 men and women in the United States more or less qualified for work in chemical industries.

More than ninety per cent. of the total bauxite in America comes from Arkansas and the other ten per cent. came from Georgia, Alabama and Tennessee. Aluminium metal is made from bauxite by electrical methods which were invented and first carried out in the United States. Aluminium is made in Canada, but heretofore from imported bauxite. Deposits are reported in Canada, but have not yet been developed.

Under the direction of Sir Evan Jones the British Board of Trade has created a dye branch to keep in official touch with the growing dye industries. Sir Evan Jones has the title of Commissioner of Dyes.

The Union Government of South Africa has created an Industries and Advisory Board and a Scientific and Technical Committee. A section of the new body has established a publication called the "South African Journal of Industries."

Canadian Wood

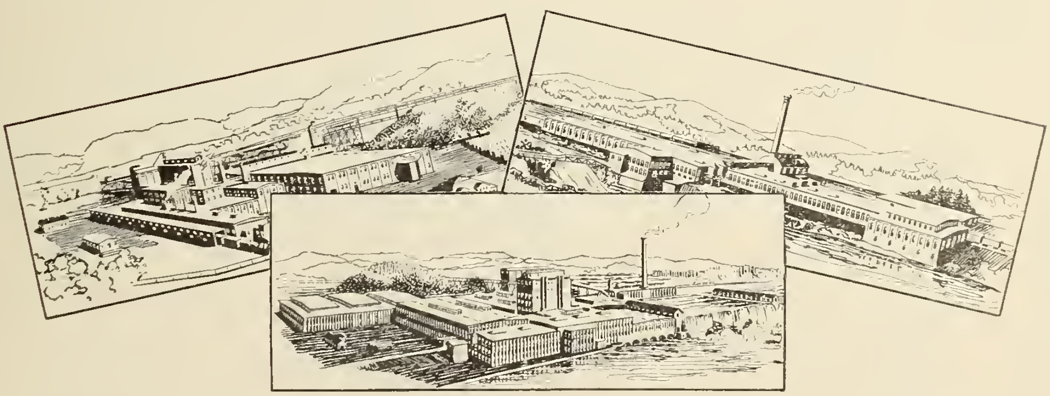
TURPENTINE

Made at our Mills at La Tuque, P. Q.

A Superior Solvent and Diluent

Carries no Free Rosin

The Old Way and the New



BROWN CORPORATION

Sales Office: - - PORTLAND, MAINE, U. S. A.

Classified Index of Advertisements

Acetone—
Standard Chemical Co.

Acetates—
Standard Chemical Co.

Acids—
Coff-Garrod Co. Inc.
Dominion Tar and Chemical Co.
A Klipstein & Co.
Madero Bros.
Merck & Co.
Standard Chemical Co.
Mallinckrodt Chemical Works

Air Compressors—
Canadian Ingersoll Rand Co.

Alcohol, Wood—
Standard Chemical Co.

Alum—
A. M. Huestis.

Architects—
Samuel M. Green Co.

Arsenic—
Coniagas Reduction Co.

Autoclaves—
Valley Iron Works.
Lymans, Limited.
Thomas, Arthur H., Co.
Scientific Materials Co.
Ernest Scott & Co.

Babbitt Metal—
Canadian Fairbanks-Morse Co.

Barrels—
Charles Mueller Co., Limited
Smart-Turner Machine Co.

Bismuth, Metal and Salts—
Merck & Co.

Bleaching Powder—
Canadian Salt Co.
T. E. O'Reilly.
Wilson Paterson Co.
A. Mendleson's Sons.
A. Klipstein & Co.

Books—Technical
Gurney & Jackson

Carbide—
Canada Carbide Co.

Caustic Soda—
Canadian Salt Co.
Mendleson, A's Sons.
Wilson, Paterson Co.
Merck & Co.
Canadian Anilines & Chemicals Ltd.
A. Klipstein & Co.

Chemical Engineers and Analytical Chemists—
DeCew, J. A.
Donald, J. T. & Co.
Ernest Scott & Co.
Fitzgerald Laboratories.
Stillwell Laboratories.
Associated Geological Engineers.
Dr. Charles F. McKenna.
Samuel M. Green Co.
Toronto Testing Laboratory

Cobalt—
Coniagas Reduction Co.

Consulting Engineers—
James, Loudon and Hertzberg.
Samuel M. Green Co.
Toronto Testing Laboratory

Chemicals—
Kalbfleisch Corporation.
Mallinckrodt Chemical Works
Wm. H. Scheel.
Coff-Garrod Co. Inc.
Geigy Company Inc.
A. Klipstein & Co.
Huestis. A. M.
Lymans, Limited.
Madero Bros.
Mendleson A's Sons.
Chalmers, R. S. & Co.

Chemicals—Continued—
O'Reilly, T. E.
Standard Chemical Co.
Canadian Anilines & Chemicals Ltd.
Monsanto Chemical Works.
A. Daigger & Co.
Arthur P. Tippet & Co.
Dominion Tar & Chemical Co.
The J. F. Hartz Co., Limited

Drills, Rock—
Canadian Ingersoll-Rand Co.

Drugs—
Madero Bros.
O'Reilly, T. E.
Scheel, Wm. H.
Merck & Co.
Lymans, Limited

Dryers—
Henry E. Jacoby.
Ernest Scott & Co.
General Ceramics Co.
Toronto Pottery Co.
J. Harrison Carter, Ltd.

Dyestuffs—
T. D. Wardlaw.
Chalmers, R. S. & Co.
T. E. O'Reilly.
A. Klipstein & Co.
Wilson, Paterson Co.
Standard Chemical Co.
Geigy Company, Inc.
Merck & Co.
Canadian Anilines & Chemicals Ltd.

Electrical Apparatus—
Volta Manufacturing Co.
Samuel M. Green Co.
Canadian Fairbanks-Morse Co.

Enameled Steel Tanks and Apparatus
The Pfaudler Co.

Engineers—(See Consulting Engineers)

Engines—
Canadian Fairbanks-Morse Co.

Evaporators—
Valley Iron Works
H. E. Jacoby.
Ernest Scott & Co.

Filter Paper—
Angel, H. Reeve and Co.
Lymans, Limited.
Scientific Materials Co. x
Thomas, Arthur H., Co.
A. Daigger & Co.
Eimer & Amend.
The J. F. Hartz Co., Limited.

Fertilizers—
O'Reilly, T. E.

Formaldehyde—
Standard Chemical Co.

Furnaces and Accessories—
Volta Manufacturing Co.
Scientific Materials Co.
Samuel M. Green Co.

Grinding Machines
J. Harrison Carter, Ltd.
Canadian Fairbanks-Morse Co.

Glassware, Chemical—
Lymans, Limited.
Scientific Materials Co.
Thomas, Arthur H., Co.
A. Daigger & Co.
Eimer & Amend.
The Topley Co.
The J. F. Hartz Co., Limited
Griebel Instrument Co.

Iodine Preparations—
Merck & Co.

Laboratory Apparatus and Supplies—
Lymans, Limited.
Thomas, Arthur H., Co.
Scientific Materials Co.
H. Reeve Angle & Co.
A. Daigger & Co.

Laboratory Apparatus and Supplies—
Valley Iron Works.
Eimer & Amend
The Topley Co.
The J. F. Hartz Co., Limited
Griebel Instrument Co.

Methyl Alcohol—
Standard Chemical Co.

Magnesium—
Shawinigan Electro Metals Co.

Microscopes—
The J. F. Hartz Co., Limited
The Topley Co.

Minerals—
Coniagas Reduction Co.

Nickel—
Coniagas Reduction Co.

Oils—
Madero Bros.
Standard Chemical Co.
Canadian Anilines & Chemicals Ltd
Dominion Tar and Chemical Co.

Patent Solicitors—
Ridout & Maybee

Platinum Ware—
Lymans, Limited.
The Topley Co.
Scientific Materials Co.
Thomas, Arthur H., Co.
Eimer & Amend.
Griebel Instrument Co.

Photographic Chemicals—
Merck & Co.
Mallinckrodt Chemical Works

Pneumatic Tools—
Canadian Ingersoll Rand Co.
Canadian Fairbanks-Morse Co.

Pumps—
Canadian Ingersoll-Rand Co.
Canadian Fairbanks Morse Co.
Smart-Turner Machine Co.

Refiners—
Coniagas Reduction Co.

Stains—
The J. F. Hartz Co., Limited
Dominion Tar & Chemical Co.

Stoneware, Chemical—
General Ceramics Co.
Maurice A. Knight.
U. S. Stoneware Co.

Sulphur—
Union Sulphur Co.

Sulphur Burners—
Waterous Engine Works Co.

Tanks and Tank Equipment—
Metals Extraction, Ltd.
The Pfaudler Co.
National Equipment Co.
Goold, Shapley & Muir Co., Limited

Tanning Extracts—
Madero Bros.
Wardlaw, T. D.
A. Klipstein & Co.

Tar—
Dominion Tar & Chemical Co.

Turpentine—
Brown Corporation.

Valves—
Canadian Fairbanks-Morse Co.

Varnishes—
Dominion Tar & Chemical Co.

Wastes, Disposal of—
James, Loudon and Hertzberg.
Process Engineers, Limited.
Scott, Ernest and Co.
Samuel M. Green Co.

Wood Tanks—
Goold, Shapley & Muir Co., Limited

Zinc Dust—
A. Klipstein & Co.
Metals Disintegrating Co.

CANADIAN CHEMICAL JOURNAL

A Canadian Journal devoted to Metallurgy
Electro-Chemistry and Industrial Chemistry.

Vol. II, No. 3 TORONTO, MARCH, 1918 20c. a copy; $2 a year

For Index of Advertisements
See Page 40

Classified Advertisements
Page 45

PROFESSIONAL DIRECTORY

CANADIAN
CHEMICAL JOURNAL
A Canadian Journal devoted to Metallurgy
Electro-Chemistry and Industrial Chemistry.

Vol. 2 TORONTO, MARCH, 1918 No. 3

CANADIAN CHEMICAL JOURNAL

Devoted to the Chemical and Metallurgical Interests of Canada.

Published monthly by the Biggar Press Limited

Office, 36 Toronto St., Toronto, Canada

Telephone Main 7399. E. B. BIGGAR, Managing Director

Subscription price, $2.00 per year to Canada, United States and all parts of the British Empire.

Time of going to press, 25th of the month preceding date of issue. News and changes of advertisements should be in hand one week before.

NOTICE

The Editorial Department exercises every care to ensure the correctness of the contents of the Journal. It is understood that the authors of signed articles are alone responsible for the statements they may make, whether of fact or opinion. Address all editorial correspondence to 36 Toronto Street.

Principal Contents

Back numbers of the Canadian Chemical Journal are wanted, dating from July to December inclusive. Full price will be paid for copies received with reading matter pages in good condition.

The Fuel Situation

It would appear that the experience of the winter now leaving us should be productive, by bringing to some definite policy our treatment of the fuel problem in this country. Considering conditions as they will be after the war and having given all due credit to the possibilities of water power development, it yet remains necessary to obtain a larger measure of independence in the matter of fuel supply than we have ever attained in the past. We cannot expect to be carried along continually by the generosity of our allied neighbors. If the whole of Central Canada draws its fuel supply from the United States, Nova Scotia, and British Columbia, a false state of economic equilibrium must be maintained. Sooner or later this must break down to the damage of those industries centrally situated. No further proof of this is necessary than the recent shut down east of the Great Lakes.

No single movement constitutes a solution of this complicated situation. Our natural resources are peculiar in themselves both in situation and in kind. Questions of transportation and labor are exceedingly difficult to settle at the present time and will remain so. If, however, they were brought to their highest efficiency, there is no reason to doubt, that by the proper exploitation of both the natural water powers of Central Canada and the lignite deposits of the Western Provinces (throwing the Ontario peat deposits in for good measure), the deficit, now annually existing in coal, might be more than made up.

Both Provincial and Dominion Governments are considering this matter at the present time. More immediately the deposits of Western Canada are being discussed. The easiest mode of procedure would be to place the whole matter in the hands of private corporations. This would simply throw the burden of their immediate losses, and not their future profits, on the whole people. It is hardly to be expected that this is the best that the Dominion Government will do at the present time. Probably joint Provincial and Dominion operation will be attempted.

A programme has been submitted to the Government by its Research Council involving the establish-

ment of a lignite briquetting demonstration plant in Saskatchewan at an expenditure of $400,000. When the project for this experimental plant was brought forward by Dr. Frank D. Adams, and others, the Governments of Saskatchewan and Manitoba offered to contribute $100,000 each, but it is said that the Dominion Minister of Finance would not agree to contribute the other half. It is upon this rock of initial expenditure for experimental purposes, that the project meets its most dangerous enemies. Men well trained in established industries may easily be overcautious when large experimental propositions are presented to them. The best scientific advice in the world may not be sufficient to overcome their hesitation. It can only be pointed out that delay in taking proper measures for the future does not help a situation greatly, when it must be faced eventually. A certain well known German firm spent millions in experiments to control a single synthesis—indigo—a mere color. Should we hesitate at reasonable expenditure when the continued supply of such a vital necessity to our whole industrial fabric is at stake? "Where there is no vision, the people perish."

THE Food Controller and many others are urging a big production of maple sugar and syrup this spring. The idea is good, and school boys and girls might be given half holidays on the work as a war time experiment. There is a common belief that the making of maple sugar was taught to the white settlers of Canada by the Indians, but Benjamin Sulte traces its first production to Dr. Michel Sarrazin, who came to Canada from France in 1685. Sarrazin was a chemist and scientist who analyzed the sap and converted it into sugar. So that to chemical analysis we Canadians owe the sweetest recollections of our childhood.

IN a paper to the American Chemical Society Dr. W. G. Tucker, Dean of the Albany College of Pharmacy, argues that as fifteen thousand medical men will be required for the first American army of a million men there will be a serious depletion of doctors for the civil life of the nation. He suggests therefore, that the situation can be relieved by the employment of pharmacists whose training will enable them to render good help as laboratory and clinical assistants to the doctors in the field.

FOR half a century Canada has been eminent in the cheese industry, but in recent years, thanks to the patient work of our chemists, other products from milk are being used to build up new industries. Besides a number of milk condensing plants the production of milk powder is taking its place among the established industries of Canada. The suitability of the country to cattle raising gives a firm foundation to such industries. An article in another section of this issue contains much of interest on the operation of a modern milk powder plant, and the feature that will strike the lay reader is that the industry is essentially the creation of the chemist and the chemical engineer.

Professional Chemists and the War

IN view of the many and conflicting decisions which have been handed down by local tribunals working under the Canadian military service legislation, affecting chemists, a statement of the procedure of British authorities in this connection may be of interest.

On November 20, 1916, a list of Certified Occupations (R105) was given out in England. Under General Reservations, provision was made for the exemption of works chemists, twenty-five (afterwards made twenty-seven) years of age and over, and a footnote states "Where the works chemist at important works is under twenty-five and is the only man left in that position he should be treated as in a certified occupation."

Analytical, consulting or research chemists are to be treated as in a certified occupation if so recommended by the Royal Society. Chemists engaged in chemical trades, or in the manufacture of dyestuffs (natural or artificial) are to be treated as in a certified occupation, and analytical chemists engaged with wholesale manufacturing druggists are to be so treated if of the age of thirty or upwards.

These regulations are still in force and in November, 1917, the following statement was issued through the Proceedings of the Institute of Chemistry in England:

"A number of commissions in the navy and army and air services are still open to chemists, and men liable to military service are therefore invited to make inquiries at the Institute. The demand for the services of chemists, not only in the production of munitions of war, but in industry generally continues to increase, and considerable difficulty is now experienced in obtaining properly qualified candidates for many of the vacancies brought to the notice of the Institute."

The Dominion Government has assisted the Empire in bringing to its service at this time well organized groups of men from nearly every profession, except chemistry. It is true that an Industrial Research Board has been appointed but it has not yet brought order out of chaos.

The Convention of Canadian Chemists

THE coming Convention of Canadian Chemists at Ottawa has been arranged for the latter part of May, but the exact date has not been settled as it is intended that it shall coincide with the annual meeting of the Royal Society of Canada which has not yet been fixed. We are glad to find the interest

in this convention growing, and as it may be called the first national gathering of this kind, it is expected that the attendance will be large. Those who wish to make suggestions for the meeting should write to Alfred Burton, secretary, 114 Bedford Road, Toronto, or to Joseph Race, F.I.C., secretary Ottawa Section Society of Chemical Industry, 428 Slater Street, Ottawa.

THE article by Mr. Ostrom on water sterilization deals with a question of great importance to the public. The prevalent recourse to chlorine in the treatment of municipal water supplies cannot be accepted as a permanent solution. The application of the chemical has never been properly regulated, and the use of chlorine unfits a water supply for certain industries. The public spirited chemist will welcome, and not obstruct, any discovery which will purify water without questionable effects on the health of the drinker.

IN the correspondence section of this issue attention is directed to a public advertisement issued at Ottawa on January 10th by the Civil Service Commission of Canada. Another correspondent draws attention to this matter. In the call for the legal officer, not only is the name of the Department suppressed but the required educational qualifications of the applicant may be interpreted very broadly. He might be merely a High School pupil with a few years' experience as a junior clerk in a law office. The salary offered, $3,300, is the maximum possible under existing Civil Service regulations, $2,800 being the initial salary for Division 1A clerks, the Deputy Minister having the authority to increase this by $500 under special circumstances. In the advertisement for the chemist the requirements are laid down with detail. The applicant must be practically a Ph.D. in chemistry, with subsequent experience in practical industrial work and must be an expert in one particular line—gas analysis. These qualifications could scarcely be attained by a man under 30 years of age. His initial salary is $1,600; if he be so fortunate as to be promoted at the end of his first year to Div. 1B the salary will be $2,100, but if he remains in his initial division until he reaches the maximum it will take another five years to reach 1B. Seven years will be required to reach the maximum in this division and if promotion follows immediately to the next division without hitch the salary will be $2,800 in Div. 1A. Five years more will bring him to $3,300. Thus we see that if he receives his statutory increases each year and promotion immediately on reaching the maximum of his division, it will take the expert chemist seventeen years to reach the salary at which the mediocre law student begins. The law student, however, will automatically advance at the rate of $100 a year to a maximum of $4,000 which he will receive at thirty-five years of age. The chemist will be lucky if he has reached $2,100 at this age.

The Civil Service Commission are probably not to blame for this discrimination, but it is apparent that some department has not yet learned that chemists are no longer in the class of Dispensers but among the Indispensables.

A MINING engineer from the Cobalt region informs THE CANADIAN CHEMICAL JOURNAL that there are several millions of tons of tailings in the Porcupine and Cobalt districts containing pyrite from which a profitable percentage of sulphuric acid can be obtained. This would be started on a considerable scale if metal recovery by the oil flotation process could be combined with it, but the incubus of the German-English patent claims hangs over the proposition.

THE continued decline in the output of coal in Nova Scotia is a matter of grave concern for all industries depending on coal from that province. The output of Nova Scotia coal in 1913 was 7,263,485 long tons, but has been declining year by year till in 1917 it was only about 5,735,000 long tons. This is due partly to the failure of private capital to develop new mines, partly to the difficulty of getting new mining machinery, but chiefly to the diversion of labor from mining to the munitions plants. The serious aspect of this problem is that if labor were available it would be three years even before the Nova Scotia collieries could be brought to the point where the output would equal that of 1913. Bearing in mind that from the sea coast westward to places beyond Montreal there is no Canadian source of coal other than the Nova Scotia product there seems no prospect of remedy short of action by the National Government.

The Canadian War Trade Mission

THE embarrassments of civil trade owing to the war are many. Since the licensing system was adopted to regulate trade between Canada and the United States questions of permissible imports and exports between the two countries and for foreign trade have heretofore been referred to the British War Mission at Ottawa, but now a Canadian War Trade Mission has been created with headquarters at Washington. This was advisable as no one could know the industrial and commercial needs of Canada as well as Canadians. This new mission will act as a sort of court of intercession in behalf of Canadian industries that have business relations with the United States and other countries. Mr. Lloyd Harris, of Brantford, will be chairman. Mr. Ross H. McMaster, of the Steel Company of Canada, advisor

in iron, steel, etc., and Professor J. Watson Bain, University of Toronto, will advise regarding chemicals. acids, oils, pharmaceuticals, minerals, etc. All are able and trustworthy men, and all connected with the chemical and allied interests will be glad to know that in Professor Bain they will have a sympathetic and fair-minded intercessor. No man in Canada has a wider knowledge of conditions affecting the chemical industries.

Dr. Shuttleworth on the Industrial Alcohol Problem

Dr. E. B. Shuttleworth, whose article on the above subject begins in this number, may be regarded as one of the fathers of the chemical industry in Canada. For several years before confederation he had been instrumental in founding and conducting a laboratory in Toronto and when the Inland Revenue Act was framed, was one of the most energetic advocates of provisions in favor of industrial alcohol. After the success which followed these efforts he had the management of the first bonded factory which not only turned out a full line of alcoholic pharmacopoeial requirements but a complete series of ethers, chloroform, and other chemicals made from spirit. The Canadian Pharmaceutical Journal, of which he was one of the founders, and for thirty years its editor, did much to foster these interests and to create and keep alive the legislation which still exists.

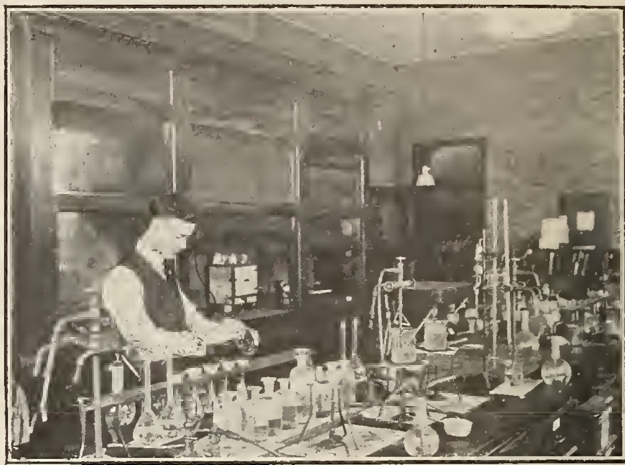
In 1903 Dr. Shuttleworth was appointed by the main distilling interests of Canada to attend the Convention on Industrial Alcohol at Berlin, and the Congress at Paris, and to report on the legislation already secured by European countries, together with the means adopted to carry it out. The information thus collected during a tour of three or four months, and the previous experience gained in Canada, besides the subsequent attention given to the subject during the doctor's incumbency as chemist to the General Distilling Company, place him in a position possessed by few authorities.

Laboratories of the Experimental Farms

The first chemical work undertaken by the Dominion Experimental Farms was carried on in a small room, temporarily equipped as a laboratory, in a house on Canal Street, Ottawa. This was thirty years ago, on the establishment of the Experimental Farms system and while as yet there were no permanent buildings on the Central Farm, which is located on the confines of the City of Ottawa to the south-west. This temporary laboratory served its purpose very well, for it enabled a start to be made on several important investigations which have since been carried forward to a successful issue.

Soil Laboratory, Dept. of Agriculture, used at present in Soil-alkali investigations

In 1888 the Dominion chemist made an inspection tour of the principal agricultural laboratories of the United States, England and Germany and on his return to Canada drew out plans for permanent laboratories to be built on the Central Farm. These laboratories with a superficies of 36×36 feet occupied one-half of the general office and administration building, a brick structure situated on the campus and which, though since enlarged, is still in duty affording accommodation for the larger number of the technical officers. The chemical suite comprised two laboratories and an office, with storerooms beneath. The lighting, arrangement and equipment were all found quite satisfactory for agricultural chemical work and here good progress was made for several years in many lines of research.



Feeding Stuffs and Fertilizer Laboratory, showing Fume Cupboard.—Dept. of Agriculture

In 1896 a disastrous fire, the result of an accident in the conduct of the Kjeldahl process for the determination of nitrogen, completely wrecked the interior of the laboratories. Fortunately the fire was extinguished before the outside walls were materially damaged and it was found possible to refit the laboratories to carry on the chemical work until such time as a separate chemical building could be erected, for it was at once decided that the ever increasing chemical work demanded more accommodation than the general administration building afforded and that in a separate building the chemical operations would not endanger, in case of accident, the main building.

The new chemical building constructed of red brick, and lined throughout with cream colored pressed brick to make it as fireproof as possible, was ready for occupation in August, 1899. The dimensions were 37×40 feet. It contained two laboratories and two offices on the main floor, with full basement and attic for store rooms, preparation rooms, accommodations for photographic work, etc.

In 1912 it was found necessary to enlarge this building, to afford more convenient working room for the increased chemical staff and for the better carrying on of the several classes of investigations which as the years went by multiplied greatly.

The enlargement, which was finished, equipped and ready for occupation in 1913, doubled the size and more than doubled the working capacity of the original building, adding four laboratories each 33.6×17.6 feet with several offices, store rooms, a small library, etc. The accompanying photographs illustrate the general arrangement, lighting, etc., of several of the larger laboratories.

The annual reports of the Division of Chemistry indicate fairly well the exceedingly wide and varied field covered by the activities of the Division. They include investigations relating to soils and the maintenance of their fertility, manures and fertilizers, crops of all kinds, feeding stuffs and feeding experiments with stock, insecticides and fungicides, well waters

from farm homesteads, etc. In addition to the work which may be considered as strictly agricultural, examinations are made of the products of the packing houses, for the Health of Animals Branch, analyses of various materials submitted by Departments of the Government service not possessing laboratories and chemical staffs, and during the past three years the examination of a large number of samples in connection with war supplies.

Large Electric Vacuum Oven, used in Moisture Determination of Flour.—Dept. of Agriculture Laboratory

The equipment of the laboratories, in addition to the usual water, gas, suction and blast connections, includes a considerable amount of apparatus operated by electricity, such as vacuum ovens, fat extraction apparatus, arsenic testing apparatus, mills and grinding machinery of various character, etc.

The staff of the Division consists of the Dominion chemist, eight assistants (three of whom are absent on military service), a supervisor of field experimental work in fertilizers, and a clerical staff. In addition to the research work proper a large correspondence of an educational character is carried on with farmers and this entails a very considerable amount of desultory analytical work in connection with soils, feeding stuffs, etc., sent in for examination and report. This feature has proved one of the most useful phases of the Division's work and is highly appreciated by farmers. It has undoubtedly played a valuable part in the progress that Canadian agriculture has made in recent years.

As an illustration of the amount of work passing through the laboratories relating to agriculture it may be noted that in the official year 1916, 4,393 samples were reported on, including 1,180 samples from packing houses. The packing house samples were sent in by the meat inspection division of the Health of Animals Branch, but nearly all the others came from farmers and related to soils, marls, manures, forage plants, waters, dairy products, insecticides, etc. The samples sent in have more than doubled in the last three years.

A feature of the work relating to the farm which has an important bearing on Canadian industry is the testing and analysis of the sugar beet from samples grown on the seventeen branch experimental farms and stations.

Considerable work is done for the provincial agricultural authorities and this resulted in the issue of a special bulletin on "Lime in Agriculture," showing the use and abuse of lime in its bearing on soil impoverishment. Experiments were made to ascertain the value of fish waste such as star fish and dog fish and of basic slag, nitrate of soda, seaweed, sulphate of ammonia, etc., as fertilizers, and the results are detailed in the annual reports of the "Division of Chemistry," Department of Agriculture. Another interesting feature is the reports on the various chemical preparations for spraying fruit trees and for insecticides and fungicides. Generally speaking the compounds put on the market by Canadian firms indicate honest endeavors to furnish a good article.

Now that so much thought is given to the problem of more production and better farming methods the work done in past years by Dr. Frank T. Shutt, the chief chemist, and his efficient staff, in educating the leaders in agriculture on the fundamental conditions of progress will be better apprehended.

The Nickel Industry of Canada

(Concluded)

In our last issue the history of the nickel industry of Canada and the United States was traced to the year 1911.

The present paper read before the Society of Chemical Industry, Toronto, by E. P. Mathewson, General Manager of the British America Nickel Corporation, brings the history down to the present time:—

The use of nickel has been increasing tremendously during the past seven years, and the great War has emphasized its importance to an extent never dreamt of heretofore. Some of the greatest engineering structures of the world have been recently completed and but for the use of nickel as an alloy in the steel employed, their construction would have been entirely out of the question. One of the most recent of these structures is the great Quebec Bridge.

The lack of nickel in Germany after the first few months of the War caused our enemies to offer tremendous inducements to producers to supply them with nickel. They were successful in securing a supply from Norway, which, however, by means of certain negotiations on the part of the British Government, were cut off almost entirely, and in May of this year, the refinery at Kristianssands was damaged by fire to such an extent that no nickel has been produced at that plant since that time.

The affair of the Deutschland is familiar to all and caused a feeling of uneasiness amongst the Allies at the time.

It is no secret to state that the nickel producers, particularly the International Nickel Company, of which the Canadian Copper Company is the chief subsidiary, became much alarmed at what they considered a lack of market for nickel proportionate to their producing capacities.

Our friend, the late D. H. Browne, was employed for some time to study the various uses to which nickel could be put, with a view to augmenting the market for his company.

Just before the war broke out, the manufacturers of structural steel seemed suddenly to become aware of the value of the nickel steel alloy and its use was increasing rapidly. When the war broke out, the demand for nickel in the war industries absorbed the entire supply, and it is generally believed that after the war, the demand for nickel will continue to a still greater extent.

In connection with the automobile industry, the consumption of nickel is quite large and growing constantly. For the fabrication of shafting, particularly marine shafting, nickel seems to be essential, but the great consumption of the metal will be in the form of nickel steel alloy for structural purposes.

Within the past few years, the enormous reserves in the lower levels of the Creighton Mine have been discovered, and at this time, a very important investigation is being made by the Mond Nickel Company on the lot west of the Creighton Mine, where diamond drilling is being undertaken with the object of striking the Creighton ore body extension at a depth of 3,800 feet. This is twice the depth of any of the workings in the nickel region of Canada.

Some very interesting diamond drilling has been undertaken in the eastern part of the Sudbury district by the Longyear Company, they having drilled through 100 feet of wash and found nickel ores at some distance below the wash.

The Mond Nickel Company have moved to a point eight miles east of Sudbury on the Canadian Pacific Railway and constructed

a modern smelter and model town called Coniston. The houses in this town are very well constructed and the streets are well laid out. In fact, the word "model" is properly applied to this town.

Mr. Browne refers to the old Murray mine, and this mine is now the principal holding of a new company formed a few years ago and incorporated as the British America Nickel Corporation, Limited. This company is the successor of several of the older companies. Messrs. Booth and O'Brien, the famous lumbermen and contractors of Ottawa, became interested in the nickel properties many years ago, particularly what is known as the Whistle Mine. They built a railroad to this mine and built up quite an establishment, did a lot of diamond drilling and proved up the presence of considerable ore.

They interested the late Dr. Pearson, and he, with a number of his financial friends, organized the company above mentioned. His company acquired the holdings in nickel properties of the Lake Superior Corporation, and the Murray Mine. The diamond drilling was continued at the Murray Mine, and here an unexpectedly large body of ore was discovered, so that the plans of the company immediately concentrated on this property and preparations were actively begun for the erection of a smelting plant and refinery near that mine.

The tremendous depression in financial circles at the beginning of the War had its effect on the nickel industry and particularly on this new company. Work was suspended, and shortly afterwards, Dr. Pearson lost his life on the ill-fated Lusitania. Some of his business associates took steps to see what could be done with the British America Nickel Corporation, and as the company owned the Hybinette patents for refining nickel, which are considered very valuable and which had been in operation for a number of years at the Kristianssands Refinery, Norway, decided to resume the construction of the plant at Nickelton, and this work is now well under way.

Nickel became a political issue in Canada, but with the entry of the United States into the War on the side of the Allies, this ceased to interest politicians. However, one good result of the nickel agitation was the appointment of the Royal Ontario Nickel Commission, which recently completed its labors and published a voluminous report, which is generally considered to be the finest thing of the kind ever offered to the public. The Commission arrived at the following conclusions:

"1. The nickel ore deposits of Ontario are much more extensive and offer better facilities for the production of nickel at a low cost than do those of any other country. Nickel bearing ores occur in many parts of the world, but the great extent of the deposits in this Province, their richness and uniformity in metal contents, and the success of the industry points strongly to the conclusion that Ontario nickel has little to fear from competition.

"2. Any of the processes now in use for refining nickel could be successfully used in Ontario, and conditions and facilities are at least as good in this Province as in any other part of Canada.

"3. In view of the fact that practically no chemicals are required, that there is a much more complete saving of the precious metals, especially platinum and palladium, and that electric power is cheap and abundant, the most satisfactory method of refining in Ontario will be the electrolytic.

"4. The refining of nickel in Ontario will not only benefit the nickel industry, but will promote the welfare of existing branches of the chemical and metallurgical industries, and lead to the introduction of others.

"5. The methods employed at the Ontario plants of the two operating nickel companies are modern and efficient, although there are differences in both mining and smelting practice. It is the consistent policy of both companies to adopt all modern improvements in plant or treatment. Even during the present time of acute pressure, the Canadian Copper Company has materially increased its output without substantial enlargement of its plant, and the losses in smelting are less, both at Copper Cliff and the Mond plant at Coniston, than they were a year ago. These companies have each had their experimental stage, neither has asked nor received any Government assistance, and both have earned the success which they have achieved.

"6. The present system of mining taxation is just and equitable and in the public interest, and is the best system for this Province. Any question of change is rather one of rate than of principle.

"7. Experiments have been undertaken by the Commission in the production of nickel-copper-steel direct from Sudbury ores, and also in the electrolytic refining of nickel. Certain improvements in the latter process have been made the subject of application on behalf of the Government of Ontario for patents in Canada, United States and Great Britain."

The Commission further states that, "the proven or positive ore of the Sudbury area can be conservatively put at 70 million tons, while it is safe to say that the proven, together with the probable and possible ore supply, exceeds 150 million tons. The International Nickel Company's published estimate of their ore reserves is 57 million tons, which is for three mines only. Although the Sudbury districts have been worked for twenty-nine years, there is vastly more ore proven in the district today than there was five years ago.

"No such vast deposits of workable ores, considered as a source of metallic nickel, are known in any other country, and there is no reason to believe that any competition will arise with which Ontario cannot cope."

Since the report of the Commission has been made public, the rate of taxation on nickel properties has been materially increased, with a corresponding increase in revenue to the Government, which more than justified the expense of the Commission.

Canada's importance as a nickel producer has been maintained through all these years, and it now is apparent that Canada will soon become equally important in the refining of nickel.

The International Nickel Company has under construction, and near completion, a modern refinery at Port Colborne, Ont., which will have an initial capacity of 7,500 tons of nickel per annum, and provision has been made for enlargement to double that capacity.

The British America Nickel Corporation's plant will be nearly the same size as the Port Colborne plant, but will utilize the Hybinette electrolytic process, which is quite distinct from that used by the International Nickel Company, and in it also will be made provision for enlargement as the needs of the industry demand. This plant, however, will not be completed until the year 1919.

The Power Problem at Niagara Falls

Editor Canadian Chemical Journal:

Sir,—The January and February numbers of The Journal are to hand and I have already got my money's worth. Canada is fortunate in having a publication of such merit.

In the article on "The War Born Twins of Industrial Canada" the writer asks, "What steps are the Canadian Government taking to secure the early production of the chemicals based upon nitrogen, which as already shown, are of paramount national importance.?"

The answer to this question would seem to be supplied by observing the situation of the American Cyanamid Company, of Niagara Falls, Ont. While the Ontario Hydro Electric Commission is selling power which it does not yet possess there is a shortage of power for this plant. As a consequence the company is making plans for erecting a new plant in the United States. The Canadian Aloxite Company has been forced to build an extensive plant at Shawinigan Falls because power cannot be obtained at Niagara Falls. The Norton Company, of Chippawa, is also hard pressed to obtain power. All of

these companies are essential not only to Canada's industrial growth but also for the empire's success in war.

The remedy lies in ceasing to scatter Niagara Power all over Ontario regardless of economical considerations and to devote the main part of this power to electro-chemical processes. The economical place to do this is at Niagara Falls. To promote the manufacture and distribution of electro-chemical products Niagara Falls can be connected with Canada's great canal system at trifling expense. The original plans for the new Welland Canal called for a dam and lock at Port Robinson a few miles above Chippawa in the Welland river. This lock could be placed at Chippawa, almost the only extra expenses being the payment of damages for flooding a few acres of almost worthless farming land. Then at a cost of $50,000 (so the writer has been assured by a competent engineer) the proposed Chippawa power canal could be converted into a ship canal as far as Lundy's Lane at Niagara Falls. Thus Niagara Falls would become the greatest electro-chemical centre in the world to the great advantage of Canada and the British Empire.

The practical politicians laugh at this dream. Cannot Canadian chemists do more than wonder what the Government is doing? Cannot they get together and impress upon the Governments of Canada and Ontario the vital necessity of development along electro-chemical lines?

Yours truly,

M. N. A.

Advisory Council of Scientific and Industrial Research

The Research Council held a meeting at Ottawa last month at which a number of important questions connected were considered.

A memorandum was forwarded to the Government urging that immediate action be taken to make available to the people the varied fuel resources of Canada in the coming year and placing the services of the Research Council at the disposal of the Government to that end.

A grant was made for the investigation of the question of recovering the immense quantity of sulphite liquor now thrown away by the pulp mills of Canada. It is hoped that certain new industries may be established using these waste liquors as a raw product. The utilization of the waste ammoniacal liquor from Canadian gas works was also considered, this product containing large quantities of ammonia of value as a fertilizer.

The Council, at the request of the Institute of Civil Engineers of Great Britain, also took steps to bring before the Government and certain manufacturers of Canada the importance of Canada associating itself with the movement which has recently been organized in Great Britain, the United States and France for combined action in connection with the standardization of various engineering products used and exported from these countries. This is a matter of great importance in connection with the building up of an export trade in this class of products by Canada at the close of the war.

It was decided also to approach the Canadian Manufacturers Association on the question of the development of Trade Organizations for the promotion of research, etc., in connection with groups of industries, such organizations having been developed with most beneficial results in Great Britain and in the United States.

The Council decided to issue a series of short bulletins dealing with some of the more important questions regarding the raw materials and certain manufacturing problems of public interest.

The Council considered a memorial from the British Columbia Canners Association calling attention to the danger of exterminating the sockeye salmon through over fishing and the obstructions in the upper reaches of the Fraser River. The Council passed the following resolution which was sent to the Minister of Marine and Fisheries.

"The Research Council and the Biological Board of Canada unite in recommending that the Dominion Government take steps to arrange a convention with the Government of the United States looking towards the appointment of an International Commission which shall have the control of the salmon fisheries of the Fraser River and of all those waters through which the fish pass to reach the Fraser River, this Commission to have full power to make and enforce regulations for the effective conservation and the restoration of these fisheries."

The International Commission as suggested would have powers similar to those of the International Waterways Commission appointed by the Governments of Canada and Washington. This, in the opinion of both the Research Council and the Biological Board of Canada with whom the Council conferred is the only way in which the sockeye salmon can be preserved and the canning industry of British Columbia continued.

Recent Canadian Patents

Of Interest to the Chemical and Metallurgical Industries

No. 179,048. Conversion of sulphonic acid into a salt. L. M. Dennis, Ithaca, N.Y. A method of separating a sulphonic acid of a hydrocarbon of the aromatic series from sulphuric acid.

No. 179,118. Nitric Acid Concentration, The Canadian Explosives, Limited, Montreal, Que. By passing nitric and sulphuric acids into a chamber and driving off the nitric acid by means of vapors from a boiling solution of sulphuric acid, collecting and recovering the nitric acid and oxide vapors.

No. 179,121. An alloy for cutting tools composed of zirconium and nickel or cobalt. The Cooper Company, Cleveland, Ohio.

No. 179,145. Aluminium Chloride Production. The Standard Oil Company, New York. Treating aluminium Carbide with Hydrochloric Acid in a heated retort and collecting the volatilized aluminium chloride.

No.'s 179,151 and 179,152. A porous filter and method for testing same. The Zahm Manufacturing Company, Buffalo, N.Y.

No. 179,165. Ore Flotation Process, E. A. and H. C. Colburn, Colorado Springs, Colorado, a flotation process making use of different pressures.

No. 179,208. Steel alloys, P. R. Kuehnrich, Sheffield, Eng. Converting a carbon chromium steel into a high speed steel by the addition of 1 to 6 per cent. of cobalt.

No. 179,252. Transforming Mineral Oils. The Bostaph Engineering Company, Detroit, Mich. A process of partially oxidizing hydrocarbons by bringing into contact in vapor state with a reducible oxide at regulated temperature.

No. 179,256. Alloys of aluminium, zinc, magnesium and iron. The Canadian General Electric Company, Limited, Toronto.

No.'s 179,271 and 179,272. Mineral flotation using alpha-naphthylamine and nitro-naphthalene with or without oil. The Metals Recovery Company, New York.

No.'s 179,281-2-3-4. Methods of producing titanic oxide from material containing it and iron oxide, by heating in the presence of an alkali sulphide. The Titanium Alloy Manufacturing Company, New York.

No. 179,285. Alloys of iron, cobalt and a material proportion of silicon. The Union Carbide Company, Limited, Welland.

No. 179,296. Process of making calcium arsenate by action of calcium hydroxide and arsenic acid in the presence of sodium hydroxide. G. R. Riches and W. C. Piver, Hoboken, N.J.

No. 179,320. Electrolytic apparatus. W. E. Greenawalt, Denver, Col.

No. 179,321. A process of mineral flotation in which the sinking products are successively re-treated to obtain a final complete separation. H. E. T. Haultain, Toronto, Ont.

No. 179,332. Method of treating the gases in ore smelting. F. L. McGahan, Los Angeles, Cal.

No.'s 179,354-5-6. Process of inducing vulcanization of rubber by the addition of an organic peroxy compound and other chemical reagents. The Canadian Consolidated Rubber Company, Limited, Montreal, Que.

No. 179,379. Inducing vulcanization in rubber by organic dyes and other reagents. W. E. Lake, New York.

No. 179,414. Method of concentrating ores by froth producing agent, agitation and settling; and continuously removing the froth and settlings. F. Groch, Cobalt, Ont.

No. 179,490. Producing alloys of copper, lead, zinc and tin by adding the solid metals to the molten copper outside of the melting temperature. Standard Underground Cable Company of Canada, Limited, Hamilton, Ont.

No. 179,495. Filtering dust from hot furnace gases by means of matted steel threads and steel wool. Kling & Weidleine, Youngstown, Ohio.

Lapsed Patents

(Reported by Hanbury A. Budden, Patent Solicitor, Montreal)

The following patents taken out in Canada lapsed in January because of non-payment of fees. These patents therefore become public property.

No. 137,684. Fertilizer, taken out by Knosel, Germany. Mixture of sulphite cellulose waste lye with calcium cyanamide.

No. 137,694. Vegetable fiber manufacture. Podmore, U.S. Treating with alkaline solution in presence of steam and separating with suction.

No. 137,699. Artificial stone. Rommel, Germany.

No. 137,707. Rubber substitute. Von Vargyas, U.S. Vulcanized composition of uncured rubber, cork flour and a binder.

No. 137,765. Iron milk manufacture. Hoering, Germany. Mixing milk with glycero phosphate of iron.

No. 137,789. Protein manufacture. Vasey, England. Dissolving protein in caustic alkali treating with phosphoric acid.

No. 137,839. Coating process. Antoni, Germany.

No. 137,840. Paper pulp manufacture. Arledter, England. Heating with alternate pressure and vacuum.

No. 137,874. Glue manufacture. Hein, U.S. Treating with a nitrate.

No. 137,907. India rubber substitute. Tolkien, England. Chlorides, nitrate and formalin with farina.

No. 137,963. Peat drying process. Abresch, Germany. Mixing hard dried peat with raw peat and pressing mixture.

No. 137,979. Lamp filament. Nernst, Germany. Heating tungstate oxide in a reducing atmosphere.

No. 137,990. Oxygen generation. Beltzer, U.S. Heating two-thirds bleaching powder one-third slaked lime.

No. 137,995. Water purification. Brandes, Germany. Exposure to sunlight over aluminium plate.

No. 138,136. Gas producer. Stewart, England.

No. 138,178. Rotary kiln. Leitner, Austria.

No. 138,185. Extracting oil from animal matter. Metzger, U.S. Heating without moisture.

Pyrites in the Sulphite Mill

(From a paper presented by A. W. G. Wilson, B.Sc., Ph.D., Chief Engineer, Metalliferous Deposits, Department of Mines, Ottawa, Ont, before the Technical Section of the Canadian Pulp and Paper Association, at Montreal, on January 31st.)

Introductory

Sulphur is one of the most important chemical substances used in the manufacturing industries, and so wide and varied are its uses that an adequate supply is essential to the industrial life of any country.

This element occurs in nature in the native state and in combination as sulphides the most important being those of iron, copper, zinc and lead. Its occurrence in Canada is practically entirely confined to the latter state and the sulphide of iron—pyrites—is the only one of these ores which has as yet been utilized for the sulphur content.

Prior to 1915 native suphur was imported from Sicily, the states of Louisiana and Texas, and from Japan. Since 1915 the imports have been entirely from Louisiana. Statistics from the Department of Customs show that importations have increased from 45,669,739 pounds in 1910 to 164,890,150 pounds in 1917. While the price formerly was $20.00 per long ton, f.o.b. Galveston, recent New York quotations are $45.00 to $46.00 per long ton.

During the same period the Customs Department's statistics show that exports of pyrites have increased from 30,434 tons in 1910 to 279,646 tons in 1917.

Our requirements of sulphur for 1918 are now estimated at 110,000 tons (2,000 pounds) exclusive of 24,000 tons which Canadian pyrites will be called upon to supply.

Coming to the sulphite industry the pulp mills state that their requirements will be 73,500 tons of sulphur from which we learn that the average estimated consumption of sulphur per ton of sulphite pulp produced is 300 pounds. The averages in pounds per ton for the provinces being: New Brunswick, 310; Quebec, 273; Ontario, 313; and British Columbia, 370. As 250 to 270 pounds per ton is deemed sufficient in the best practice it would appear that there is room for considerable improvement in the methods in force in many of our mills.

Pyrites in Canada

The pure mineral, pyrite, contains 53.34 per cent. sulphur and 46.66 per cent. iron. The commercial ore, pyrites, consists of the mineral, pyrite, in association with other minerals of less or no sulphur content.

The sulphur content of commercial ore is determined by the market. Previous to 1915 a content of at least 38 per cent. was demanded. At present ore of 35 per cent. sulphur is readily saleable and ore as low as 30 per cent. sulphur has found buyers. The average sulphur content for all ore mined in 1916 was 37.8 per cent.

Statistics from the Division of Mineral Resources show that the production of pyrites in Canada has steadily increased from 53,870 tons in 1910 to 309,251 tons in 1916 and 413,511 (estimated) in 1917, with a corresponding increase in value from $187,062 in 1910 to $1,084,095 in 1916.

Ore for the sulphite industry should be practically free from gangue material; from other sulphides; from lead, zinc, arsenic, antimony and selenium; should be as high as possible in sulphur and be of good roasting quality.

Quebec pyrites contains 1 to 5 per cent. copper, is high in sulphur, low in impurities and has a ready market. Ontario pyrites is rather high in silica, but is free from copper and low in other impurities and is free burning. British Columbia ore contains copper, but is high in suphur.

The following are some typical analyses, giving percentages:

	S.	Fe.	Cu.	Zn.	Pb.	As.	Insol.
A........	48.5	40.9	4.2	0.2	1.5	0.3	3.5
B........	46.0	44.5	2.1				7.4
C........	38.0	34.0	3.0				25.0
D........	33.0	50.0	3.5				13.5
E........	40.7	35.9	3.6	0.8	tr.		12.2
F........	42.5	36.4	3.3			tr.	11.3
G........	40.0	35.0					25.0
H........	31.0	27.0					41.0
I........	41.6	36.4					21.5
J........	43.0	39.5	1.8				15.7

The samples are of ore from: A—Spain; B—Virginia; C—New York; D—Vermont; E and F—Quebec; G. H. and I—Ontario; J—British Columbia.

Producing Districts.—Quebec has two producing mines—the Eustis, near Sherbrooke and the Weedon, near Weedon—two of the most important on the continent. Ontario has

producing mines near Sulphide and Queensboro; two north of the Soo at Goudreau, and one at North Pines near Graham Junction; a mine west of Fort William near Mokomon will soon begin production. In British Columbia large bodies of ore containing some copper are known, but there are no regularly producing mines.

With two exceptions these mines are owned by companies in the United States and the purchasers of Canadian pyrites ore are all United States firms.

Prior to the war Spanish and Portugese pyrites ore was imported into America in enormous quantities and regulated the price, but for some years to come the price will largely be regulated by the price of Louisiana sulphur and by any action of the United States Government regarding the export of this commodity.

Prospective Production in Canada.—Extensive exploration and development have been in progress in several localities and many promising prospects are known, the value of which can be determined only by careful and systematic examination by experts.

New Brunswick has some deposits of pyrrhotite of 39 per cent. sulphur capable of utilization in skilful hands. Quebec has promising prospects near Sherbrooke. In Ontario excellent prospects occur near Tweed and Madoc. Prospects are also known in the Porcupine, Soo and Fort William districts. British Columbia contains many promising prospects and an abundant supply of this ore is available on the Pacific Coast.

Cost of Pyrites

The cost of mining pyrites varies with different localities. Under present conditions a fair average could be taken at $2.00 per ton, although large producers should be able to operate at a mining cost of $1.50 per ton.

A number of properties are being temporarily operated on a royalty basis of from 10 cents to 25 cents per ton, the operating companies guaranteeing a certain minimum output and paying operating and development expenses.

Concentrating methods may be used with suitable low grade ores, the cost of which would run from 60 cents to $1.20 per ton of ore treated.

Transportation costs influence the value of pyrites. Approximate railway freight rates for minimum car loads may be given as from 0.80 per gross ton for short haulage of five to fifty miles to $2.30 per gross ton for haulage of from 375 to 400 miles (tons of 2,240 pounds).

The mill owner, however, in estimating the cost of sulphur in pyrites for comparison with the cost of an equivalent amount of native sulphur can base his estimates on market quotations, making additional allowances only when the cost of delivery at his plant would exceed the cost of delivery from the mine to the New York or Boston markets.

Purchasing Pyrites.—Quotations on pyrites ores are usually given at so much per unit, a unit being one per cent. of a long ton, or 22.4 pounds. A 40 per cent. ore contains 40 units; at a quotation of 20 cents f.o.b. Atlantic coast points, the market price would be $8.00 per long ton The quotations for arsenical pyrites are usually from one to two cents lower than for non-arsenical.

The purchaser must remember that the value of the ore depends upon its content of available sulphur and the ease with which this sulphur may be recovered. The amount of recoverable sulphur depends upon the chemical composition of the ore and the care and skill of the burner operator. A cinder containing less than ½% sulphur can be produced from pure ore but in practice the sulphur loss in this way is seldom less than one per cent.

Production of Sulphur Dioxide.—Pyrite ores are roasted in specially designed furnaces to burn as much of the sulphur content as possible to sulphur dioxide. The ore as it comes from the mine generally requires crushing as the sulphite mill can use only the smaller sizes, the fines—what will pass a ⅜ inch screen to advantage. This crushing will cost 15 to 20 cents per ton and could probably be done more cheaply at the mine.

Types of Furnaces

Fines burners may be classified as hand fired and mechanically operated. The hand fired furnaces need not be considered here. The mechanically operated furnaces are of either the single or multiple hearth type, also of either the stationary or movable hearth style. The multiple hearth types may have rectangular or circular hearths. The circular hearth group with movable stirring arms are sometimes called the "MacDougall" type of furnace.

We shall refer briefly to three types of multiple hearth furnaces —the Merton with rectangular hearths, and the Herreshoff and Wedge with circular hearths; and one movable hearth furnace—the Jones.

Merton Roasting Furnace.—This furnace has three (several) hearths, rectangular and arched in the narrower dimension. Two vertical shafts carry rabble arms. The ore is fed to top floor of furnace, is worked along by the rabbles and drops through ports to floor beneath, is worked back along this floor and drops to the next The air and gas current is in the opposite direction and the gases pass into a flue at the top near the feed hopper. A standard furnace of this type will treat 5.5 to 6 tons of ore per day with 1.5 h. p. of power consumption. A minimum of dust is claimed, also an extremely small repair bill.

Herreshoff Roasting Furnace. (General Chemical Company, New York; Nicholls Chemical Company, Montreal).—This is a multiple circular arched hearth furnace. A central shaft carries revolving rabble arms with teeth specially set so as to make the ore travel in a sort of zigzag spiral. The ore is fed automatically from the hopper above the furnace and drops from the top shelf to the outer edge of the hearth below and is rabbled inwards and drops to the inner edge (centre of furnace) of the second hearth and so on to the discharge ports on the bottom hearth. The air and gases travel in the opposite direction. The larger furnace will roast about 18,000 pounds of ore per 24 hours. The principal repair cost is for the rabble arms. The breaking down of a bolted arm in the newer large furnace would put the furnace out of commission for about a week. A very effective temperature control within the furnace is claimed.

Wedge Mechanical Roaster (Wedge Mechanical Furnace Company, Philadelphia).—This furnace has one, three, five or seven circular hearths, with horizontal top surfaces and arched under surfaces. Central shaft is 5 feet in diameter, hollow and open at top and bottom and is protected on outside by fire brick which revolves with it. Rabble arms are water-cooled and an arm can be replaced in about forty minutes. Several varieties of rabble blade holders and blades are used and a special dryer-plow, holder, and rabble are used on the top of the furnace where the ore is dried before entering the furnace. Different sized furnaces have maximum capacities of from 23 to 33 tons (2,000 pounds) of 50 per cent. sulphur ore per 24 hours.

Jones Cylindrical Roasting Furnace (Can. Patent No. 141,243). This is a rotary kiln divided into a number of compartments by fire brick. The kiln is heated by means of sulphur vapor from an auxiliary sulphur burner. Ore about ¾ inch size is dried by heat from the gases in a drying cylinder and passes to a hopper in the stack when it is further heated by the gases which surround this hopper and is fed into the kiln by a worm feed. A furnace 8 feet in diameter by 100 feet long should burn 18,000 pounds sulphur per day with suitable ore producing a gas of 10 per cent. SO_2. High grade ores, if crushed fine are apt to slag in this furnace. It operates best with 40 per cent. fairly coarse texture ore.

Furnaces for Sulphite Practice.—Any one of the four types of furnaces mentioned could be operated commercially in

a sulphite mill. There are also several of the MacDougall type differing in details from the two mentioned which would prove efficient. Satisfactory data as to comparative cost of installation and operation of these different types is not available. It may be stated that the furnace requiring the least regulation, supervision and attention, of standard design and with easily replaceable parts will be the best to employ.

CHARACTER OF THE GASES PRODUCED.—Comparing the gas produced from pyrites with that from sulphur we find that the gas from a modern multiple hearth mechanical roaster contains 8 to 12 per cent. SO_2, while sulphur burners produce a gas containing 12 to 16 per cent. SO_2, the latter gas containing two to three times as much free oxygen as the former. This free oxygen is objectionable as it leads to oxidation in the products. Experiments with adequately cooled systems of absorption have shown that the weaker gas from pyrites gives better and more economical results than the richer gas from ordinary sulphur burning equipments.

The question of the utilization of pyrites as a substitute for sulphur in the sulphite mill is now nothing more than a question of relative cost, and while some mills are so situated that they can more economically use native sulphur there are many others which could substitute pyrites to a considerable saving in their annual costs.

THE CINDER, which will rarely contain less than 2 per cent. sulphur may be nodulized in a cement kiln. If copper or precious metals are present they are first recovered by smelting or by roasting with salt and leaching with water.

Cinder is suitable for the manufacture of iron alloys, but to be valuable requires a nearby market and the majority of mills in Canada can best utilize their cinder for road making and such purposes.

Pyrites Burning Equipment for a Sulphite Mill

In designing a pyrites burning equipment as far as possible all units apt to get out of order should be in duplicate, or at least one reserve unit should be provided.

An efficient plant will be designed to reduce labor charges to a minimum by the mechanical handling of ore and cinder. Every advantage should be taken of the location, where possible the ore should be delivered to storage bins above the level of the tops of feed hoppers. Belt or bucket conveyers should replace hand labor and barrows in the handling of both ore and cinder unless local conditions supply very cheap labor.

The equipment required may be briefly described as follows:

ROASTING FURNACES.—The number and size will depend upon the output and the quality of the ore. It is well to provide sufficient capacity at the start and allow for low grade ores. A mill producing 100 tons of sulphite per day requires the combustion of about 27,000 pounds of sulphur, which will require, for instance 36.5 tons of 35 per cent. ore. This could best be treated by 2 units of rated capacity of say about 25 tons per day.

FLUE.—The flues from each furnace will discharge into a common main flue large enough to collect the coarser particles of dust. The bottom should be hopper shaped and provision made for removing the dust.

DUST CATCHER.—These consist of various schemes for the retarding of the current of gas by the introduction into the flue of various styles of baffle walls, vertical or horizontal. Bundles of wires hanging from the top also prove efficient. A recent and effective means is by the Cottrell process in which the particles are electrified by a high potential static discharge in special conduits and are attracted to and deposited upon suitable collecting surfaces from which the accumulations drop to a discharge hopper at the base of cleaner.

In any dust catcher provision must be made for removing the dust without disturbing the gas current or increasing temporarily the amount of dust in same.

SCRUBBERS.—These give the gas a final washing. There are various forms: the vertical type using a water spray from jets at the top, or using coke, brick, etc., and a spray of water; the rotary type using a horizontal spray from a rotating cylinder.

The water can be circulated by a centrifugal pump and used over and over again. When it becomes too strongly acid and loaded with dust fresh water may be added.

It is advisable to instal a set of scrubbers in series and not to depend upon a single scrubber only.

COOLER.—At 0°C. (32°F.) and standard pressure water will absorb 70.8 times its volume of SO_2, giving a solution containing 18.6 per cent. SO_2. At 20°C. (68°F.) water absorbs 39.4 times its volume giving a 10.1 per cent. solution. Cooling of the gas and the keeping cool of the absorption system is therefore very important. The ordinary system is to pass the gas through a series of large pipes immersed in circulating water.

It is suggested that auxiliary air coolers consisting of two vertical pipes connected at the top be interposed between the dust catcher and the scrubbers.

FANS AND PUMPS.—A fan, generally of the centrifugal type, is introduced into the gas system, generally just in front of the scrubbers as a means of controlling the circulation. An auxiliary pumping equipment is required to keep the scrubber water in circulation.

ABSORPTION SYSTEM.—The Tower system or the Tank System can be operated successfully.

THE COST OF OPERATING A PYRITES BURNING EQUIPMENT.—This will depend upon the quality of ore and the efficiency of equipment and operation. General estimates are apt to be misleading.

In the operation of the installation, assuming three shifts per day there will be required three furnace men and three laborers in constant attendance and a machinist for daily inspection and repair work.

In estimating costs it may be assumed that run of mine ore is worth 10 cents per unit at the mine. Allowing a loss of 2 per cent. sulphur, to produce one long ton of sulphur would require 3 long tons of 35 per cent. ore, or 2.8 of 37.5 per cent. ore, or 2.6 of 40 per cent. ore.

Considering the 35 per cent. ore the cost of burning 1 ton of sulphur may be estimated as follows: 3 tons ore, \$10.50; freight, 200 miles, \$4.50; crushing and screening at mill, 48 cents; removing 2 tons cinders, 50 cents; labor, 6 men at \$3.00—\$1.50; power, 10 horse power at \$2.00 per annum, 7 cents; supplies, oil, waste, etc., 5 cents—\$17.60 in all or \$2.13 per ton of sulphite. The difference between this cost and the cost of 1 long ton sulphur at the mill, less the cost of burning the ton of sulphur represents a balance available to pay interest and depreciation charges on the more expensive pyrites burning equipment.

There are many Canadian mills within two hundred miles of ore supplies where sulphur costs \$30.00 per ton. Under these conditions a one hundred ton mill by substituting pyrites would show a daily difference in cost of about \$163 or \$48,900 per year. This sum would represent the interest and depreciation charges on an investment of \$326,000 allowing for depreciation at 15 per cent. annually. Since a pyrites burning equipment would cost between one-fifth and one-quarter of this amount it is evident that, in the operation of a one hundred ton mill, a considerable annual saving would be effected by installing these appliances.

Technical Education for Returned Soldiers

The new Principal of Queen's University, Major the Rev. Bruce Taylor, tells of the fine manner in which Queen's is endeavoring to assist returned soldiers. The university offers vocational training in applied science and has prepared twenty-seven different courses which are designed to help men who have had some degree of previous training.

The course that a man can take to best advantage will depend to some extent upon his physical condition. Courses of training are offered in mining and metallurgy, chemical analysis and assaying, photography, drafting, telegraphy, tool-making and motor mechanics, moving picture operating and in other lines of endeavor.

Canadian Government Publications

By L. E. Westman, M.A., Inland Revenue Department, Ottawa

It is our intention to list here from month to month Government publications of a scientific, technical, or educational nature. Unless otherwise stated these publications may be obtained free, by interested parties, upon application to that department of the Government issuing the same.

Department of Interior

Water Power Branch.

Water Powers of Canada.

1. The Maritime Provinces, Prince Edward Island and Nova Scotia. K. H. Smith, 35 pp.
2. Province of Quebec. F. T. Kaelin, 37 pp.
3. Province of Ontario. H. G. Acres, 41 pp.
4. Provinces of Manitoba, Saskatchewan and Alberta. P. H. Mitchell, 78 pp.
5. Province of British Columbia. G. R. Conway, 167 pp. A series of pamphlets and papers dealing in general with the water powers at present in operation in these provinces and outlining future possibilities. Well illustrated.

Water Resources Papers—

No. 1. Report of Railway Belt Hydrometric Survey. P. A. Carson.

No. 2. Report of Bow River Power and Storage Investigation. M. C. Hendry, 345 pp., with 25 maps and plates. This paper deals exhaustively with the Bow River west of Calgary and has a direct bearing on the possible industrial development of Central Alberta and the future of irrigation in that district.

Topographical Surveys Branch.

Maps and publications. List for 1917 distribution.

Department of Mines

Mines Branch.

Bulletin No. 14 (1917). The Coal Fields and Coal Industry of Eastern Canada. F. W. Grey. 67 pp. illustrated. The subject is treated from the geological, historical, and economic viewpoints. Description given of coal companies operating in this district, including extensive account of the Dominion Coal Company holdings. This company produces nearly one-half of the total Canadian annual output. Methods of working, submarine mining, washing, coking, and by-product recovery are described. Sociology and economics of mining industry is touched upon and actual living conditions in these districts described. Total Canadian output, 1915, 13 million long tons. Output from Eastern Canada, 57% of total.

Bulletin No. 15. "The Mining of Thin Coal Seams as Applied to Eastern Coal Fields of Canada." J. F. K. Brown (1917), 135 pp. An exhaustive study of the thinner seams from the viewpoint of their proper exploitation at the present time. Twelve inch seams may be economically worked. It is pointed out that the maximum output must be sustained in order to produce dividends on capital invested. Under all possible adverse conditions a time limit is set at one hundred years for these fields. Much engineering data of value on thin seams is given.

Geological Survey, 1917—

1. Espanola District, Ontario, 1917. Memoir (102). Terence T. Quirke, 92 pp. The Espanola district is situated mid-way between Sudbury and Sault Ste. Marie on the C.P.R. The report is of value from the purely geological standpoint.
2. The Cretaceous Theropodous Dinosaur Gorgosaurus, 1917, Memoir (100). L. M. Lambe. An account of the discovery and the removal of a carniverous dinosaur found near Red Deer, Alberta. This specimen was found to have been very well preserved and has been prepared for exhibition at Ottawa. Paper well illustrated and of high information value on the subject treated.

Department of Agriculture

The Agricultural Gazette of Canada. $1.00 per annum, 10 cents per copy. Deals in general with Dominion and Provincial Departments of Agriculture and the work of their various branches. Average 100 pages per month. Contains valuable agricultural statistics and would be of special value to anyone interested in rural science or in the teaching of agriculture. Reports of research work from the various Canadian Agricultural Schools are included.

Publications available for distribution. Latest 1917 edition.

Department of Labor

Labor Gazette, 20 cents per annum. 50 pp. per month, dealing with general trade conditions in Canada. Paints, oils, chemicals, and explosives all reported busy during January. Soap factories and the manufacture of acids and drugs were particularly active.

Commission of Conservation

Conservation. A monthly bulletin published by the Commission of Conservation at Ottawa. Its object is the dissemination of information relative to the natural resources of Canada, their development and proper conservation. Articles of interest to chemists appear in nearly every issue.

Carbonizing and Briquetting of Lignites. W. J. Dick, 1917, 24 pp. A very timely issue dealing with the economic possibilities of Western low grade fuels. Since 1910 the Commission of Conservation has been considering this question. This paper is a short account of the work that has been done to date and forms the basis upon which the Advisory Council is acting. In 1916 533,642 tons of anthracite coal and 2,376,934 tons of bituminous coal were imported via Port Arthur, Fort William and Manitoba ports of entry. In 1917 the price of anthracite coal in West varied from $12.00 to $14.50 a ton. It is proposed to erect a plant with a capacity for briquetting ten tons per hour at the start. The estimated cost of slack coal up to the plant would be from 50 to 75 cents per ton. Either Estevan or Bienfait present the best advantages for serving the Saskatchewan and Manitoba markets. The by-product gas would amount to 4,000 cubic feet per ton with a heat value of 400 to 450 B.T.U. per cubic foot. The candle power of this gas, however, is below the lighting standard, but it would make a very good gas fuel. R. A. Ross, chairman of the Lignite Committee, estimates the cost per ton at $7.00 for a plant briquetting 30,000 tons per annum. At a maximum estimate of cost there is a uniform difference in favor of briquettes over anthracite of from 45 cents to $2.50 per ton in Manitoba and Saskatchewan. Tables of analyses of several samples of lignite coal are given.

Food Controller's Office

1. Canadian Food Bulletin. Weekly pamphlet dealing with the food situation.
2. Can for Victory. Practical methods for amateur canners
3. Food Service. A hand book for speakers on the food situation.
4. War Meals. Practical suggestions for saving certain foods.
5. How to Prepare, Cook and Serve Canadian Fish.
6. Regulations Regarding the Packaged Cereals Trade.

The Food Controller is very anxious to obtain wide circulation and intelligent attention for these papers.

Department of Trade and Commerce

Commercial Intelligence Branch. Weekly Bulletin. Limited to Canadian circulation only.

The following chemicals are among those reported in the Bulletin to be in special demand on the Australian market:—Acetate of lead, acetate of soda, acetic anhydride, acetyl salicylic acid, alcohol absolute, ammonium carbonate, ammonium chloride, benzoate of soda, benzoic acid, bicarbonate chloride, bichromate of soda, bromides, calcium chloride, camphor, caustic soda, chloride of lime, collodion flexile, ether, fustic, hematine crystals, lithopone, logwood, mercurials, p-amidophenol hydrochloride, phenacetin, phosphate of soda, pyrogallic acid, sal.soda, salicylic acid, silicate of soda, soda ash, sodium benzoate, sulphate of alumina, sulphide of soda, sulphur black powder, tinning flux, titanium oxalate, zinc chloride.

Quotations are asked from Canadian manufacturers by Australian wholesale drug firms on early shipments of the following: Phenazone, asperin, caffeine citrate, potassium iodide, potassium permanganate, calcium lactate; glycerophosphates, iron, calcium; hypophosphites of iron, potash, calcium, sodium; sulphonal; general potash salts; thymol; santonin; mag. carb. powder; formic acid; lactic acid; saccharine; cresylic acid.

In 1915-16 Australia imported pharmaceutical and industrial chemicals to the value of £3,000,984. Of this trade Canada received £28,491. This is a small total for Canada when the distinct advances possible in the Dominion are considered.

Professor J. Watson Bain

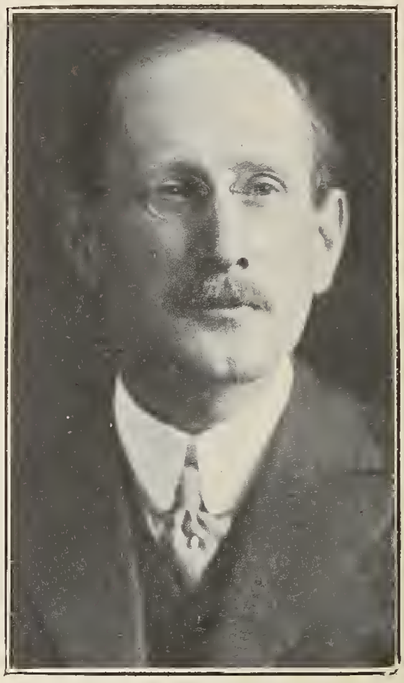
J. Watson Bain, B.A.Sc., professor of chemical engineering in the University of Toronto, has accepted the offer of a seat on the board of the newly created Canadian War Mission, and left for Washington on February 18th. The War Mission serves as a court of intercession in behalf of Canadian industries that will be regulated by the licensing system adopted to control exports and imports, and Professor Bain will be the chemical advisor.

Professor Bain was born in London, England, of Scottish parents with whom he came to Canada at the age of six. His father, the late Dr. Bain, became librarian of the Toronto Public Library, and through his enthusiasm for Canadian literature, made this library the greatest respository of Canadiana and Americana in the Dominion, and laid the foundation of the present excellent library system of the Ontario capital After education in the public schools and collegiate institutes of Toronto, the son entered the School of Practical Science, Toronto, in 1893, and graduated in mining engineering in 1897. For two years he had a fellowship here, and in 1899 was appointed demonstrator in assaying. In 1903 he became lecturer in chemistry; in 1907 was appointed associate professor of chemistry, and in 1916, became professor of applied chemistry. In March, 1917, his title was changed to that of professor of chemical engineering, which made him head of the department of applied chemistry.

During these years his services were sought in ways which brought him into contact with the practical operation of chemical and mining industries. In 1896 he was engaged in the Regina gold mill in the Lake of the Woods District and was in charge of the "school" at the custom milling plant. It was this pioneer work which contributed to the establishment of the summer mining schools that were formed under the Ontario Bureau of Mines, with which work Professor Bain was associated.

In 1899 Professor Bain was entrusted with the collection of an exhibit of Ontario minerals for the Paris Exposition of 1900, and in 1901 he took a post graduate course at the "Polyteckni-kum" in Zurich, Switzerland. For a number of years since then he has spent his summers in research and professional work of a varied kind, having been employed as an expert by corporations and individuals, including the City of Toronto; Penman, Littlehales & Company, Syracuse, N.Y.; the Consumers Gas Company, Toronto, and others. He took an important part in completing the valuable report of the Ontario Nickel Commission in 1917.

Professor Bain is a member of the American Institute of Chemical Engineers. He was vice-chairman in 1913 and chair-



Prof. J. W. Bain

man in 1914-15 of the Society of Chemical Industry, Canadian Section, for which he also served as treasurer for ten years. He is a fellow of the Royal Society of Canada.

Professor Bain's quiet and unassuming bearing and his keen interest in the progress of his students have won the good will and respect of his fellow professors as well as the loyalty and devotion of the students, and he will be greatly missed. Pend-his return his work will be carried on by the other professors at the university.

Canadian Sandstones for Pulp Grinding

A report by L. H. Cole, on the Results of Tests on Canadian Sandstones and published by the Mines Branch of the Department of Mines, Ottawa, suggests that there are several Canadian sandstones admirably suited for use as pulpstones and that with a little co-operation between the owners of prospective quarries and consumers of pulpstones an industry in this product could soon be firmly established in Canada.

In concluding his report Mr. Cole offers a further suggestion which is worthy of consideration, namely the possibility of manufacturing an artificial stone suitable for pulp grinding work. This would require a cement sufficiently hard and capable of withstanding the severe stresses and high temperature to which a pulpstone is subjected. If this were accomplished the centre part of the stone, which under present practice is discarded as useless, could be made permanent and only the outer grinding surface would have to be renewed.

Manufacture of Chemicals in Uruguay

In 1913 the National Institute of Industrial Chemistry was established at Montevidio. In 1915 a factory for the manufacture of certain chemical products in great demand was inaugurated. Ether (all kinds), sulphide of lime, are now made in sufficient quantities to meet entire home demand. Many organic preparations are being operated commercially and the young industry is in a flourishing state financially. It is not their aim, however, to compete with foreign trade under after war conditions. Courses in applied and industrial chemistry will be then established and investigatory work carried on in connection with native products.

Spirit Production and the Future of Industrial Alcohol

By Dr. E. B. Shuttleworth, Toronto

I. Present Condition of the Distilling Industry

In such topsy-turvy times as these it may seem presumptuous and perhaps foolish to indulge in speculation as to the future when it is almost impossible to say anything definite in regard to the present. With this kaleidoscopic condition, common to man and his doings, everybody has always been well acquainted but not with the rapid rotation of the instrument as witnessed nowadays. The figure presented may be accurately described but the statement may not hold good till the ink is dry. It is so with the happenings of to-day, which follow one another in such rapid succession that it is hard to keep track of the combinations —much more to say what is coming next.

The writer has been requested to give his opinions on the subject of the position of alcohol, more especially with reference to its industrial applications, but, in view of the remarkable changes which have taken place in the sentiment of the people; the political aspect of the question; the legislation actually carried out; as well as that which is foreshadowed, he could not make the attempt without referring, in a few prefatory words, to the difficulties which surround the question and the latitude which must be given on a subject of which the future is so exceedingly uncertain.

It may, at first, be well to submit a few facts and figures relating to the past condition of the distilling interest in Canada, while the present will be best indicated by data taken from the last Excise report which covers the official year, ending March 31, 1917. All figures submitted will, except otherwise stated, refer to annual periods, terminating with the Excise year, and quantities of spirit will be given in terms of proof, which is equivalent to 57.06 per cent. of absolute alcohol, by volume.

In early Canadian days, say the forties and fifties, there were more distilleries in the County of York than are now in operation in the entire Dominion. Ten years ago there were 14 licenses issued, covering 13 concerns, but five years since only eleven of these were in operation. Just before the war there were 12, which, in 1916, diminished to 9, and, last year, became 6. These were located respectively at Belleville, Prescott, Windsor, Berthierville, Montreal, and St. Hyacinthe, but formerly the operating concerns were mostly in Ontario, with only 3 in Quebec, and 1 at New Westminster.

For the official Excise year, ending in the spring of 1914, a few months prior to the declaration of war, the output of the 12 distilleries then working was 6,972,583 gallons, obtained from the fermentation of 98,044,811 pounds of grain, and 19,690,720 pounds of molasses. Production diminished somewhat in 1915, though keeping over six million gallons, but the temperance legislation enforced September 16, 1916, brought about a reduction to 3,450,011 gallons from the nine distilleries then running. Last year the six concerns still operating produced 6,400,119 gallons, using 87,740,552 pounds of grain and 27,416,716 pounds of molasses. This amount of spirit corresponded closely with that of 1913, the recovery from 1916 being altogether due to the large demand for alcohol for the manufacture of explosives, other than that recorded as fulminate.

The changes in the direct Excise tax on spirit have, of course, exercised some influence on production, and therefore demand notice. This duty had remained at $1.90 per proof gallon, since 1897, but in the war year of 1914, was raised to $2.40, thus increasing the cost of proof spirit by 50 cents per gallon, and, to a certain extent, correspondingly reducing the quantity consumed. The indirect taxes, especially that on malt, were also raised at this time and will be again referred to when this phase of the subject is presented.

The material, generically styled "grain," used in the production of spirit in Canada, consists of a mixture of malt, corn and rye, usually with a small proportion of oats, and occasional quantities of wheat. The proportions of the three chief constituents of the grain-bill—malt, corn and rye—as indicated by the five years' Excise returns prior to the war are roughly as 6.7: 57.0: 11.3, which figures may be taken as approximates, in millions, of the number of pounds fermented per annum.

The yield of spirit from grain is usually expressed in fractions of a proof gallon per pound of grain, but may be more easily remembered as referring to a hundredweight. In official tabulations the spirit produced in several distilleries is given irrespective of its source, but in the cases where grain only was employed the statistics for the five annual periods immediately preceding the war give an average yield equal to 5.928 proof gallons per hundred pounds of grain used, or at the rate of 118.56 per ton.

Another chief material used was molasses—beet and cane. Both were produced in Canada, and were of course, by-products in sugar making. The supply of the former largely stopped in 1913, owing to improved methods of sugar recovery, and in the following year the distillery in Toronto using beet molasses was closed. Since then the supply has been that obtained in the refining of raw sugar and very considerable spirit has been made from this source. Last year the distilleries at Belleville and Montreal fermented 27,416,716 pounds. The total spirit thus produced cannot be learned from the Excise returns as the Belleville record does not differentiate between spirit produced from grain and molasses, but, at Montreal, where the molasses was presumably all cane, the yield from 23,343,870 pounds was 1,116,769 proof gallons, or at the rate of 95.6 gallons per ton. This cannot be considered a high yield for such material, but closely approximates that from beet molasses, which varies from say 92 to 99, with 96 proof gallons as a fair average.

The disposal of the spirit produced in distilleries is really governed by the law which demands that all potable alcohol shall be stored for two years before appearing upon the market. This fixes the fate of the greater portion, which must thus be warehoused for the specified time. It is, however, allowable for the distiller to rectify his crude product, or high wines, as it is called, so as to separate, or fractionate it into fusel oil, low wines, non-potable alcohol, and pure spirit. The latter only must be stored, while the others are estimated, and may be disposed of at once, or kept in bond, if so desired.

The annual disposal of spirit is usually worked out in a table similar to the following which gives the combined averages of four pre-war years—1910 to 1913, inclusive, and may prove useful for comparative purposes:

	Proof Gallons
In warehouse at beginning of year	21,137,288
Warehoused during year	6,307,115
Otherwise warehoused	45,323
Taken for consumption	4,371,482
Exported	317,117
Used in bonded factories	450,385
Otherwise accounted for	461,148
For redistillation	798,571
In warehouse at end of year	21,091,023

The fact that potable spirit must be stored for not less than two years, and the belief that a longer detention still further improves its quality, sufficiently explains the first and last lines in the above computation and demonstrates the fact that there is always a very considerable quantity of spirit held in bond at distilleries, and its final disposition must be provided for in the event of further prohibitive legislation. The quantity of spirit thus held on March 31st last was 17,170,242 proof gallons, and it may be presumed that the greater part of this had been maturing for much longer than the legal period—some of it for perhaps over thirty years. It will be at once apparent that evaporation, leakage, storage expenses, and, finally, loss of interest on invested capital, very much enhance the value of this warehoused spirit, and still further complicate the problem of its destiny.

The capital invested in distilleries and the number of persons employed in their operation have no direct bearing on the subject in question other than that of guaranteeing the existence of adequate facilities and the necessary skilled labor to satisfy all probable demands for industrial alcohol for many years to come. A word or two may be said with reference to existing legislation affecting the production, importation and use of alcohol. The Excise tax on alcohol of $2.40 per proof gallon still holds good, as also that on malt, and the Customs duties on imported malt, corn, and rye are still in force. The regulations as to the conduct of Bonded Factories remain as they were, as do also the rates of Excise tax on spirit used, or products manufactured, as the case may be. The Order-in-Council of November 2nd stipulates that "on and after December 1st, 1917, and until the Governor General in Council has by Order declared that the present abnormal conditions have ceased, no grain of any kind, and no substance that can be used for food shall be used in Canada for the distillation of potable liquors." This regulation placed molasses, such as used by distillers, in a very uncertain position which, according to the newspapers, has been cleared by an announcement by the Food Commissioner which is herewith quoted:

"Reports have recently been published in certain newspapers that large quantities of raw sugar and molasses are being used in making alcohol when they might be saved for food purposes. The intention and effect of the Order in Council of November 2 is to prohibit the use of any foodstuff for the production of whisky and other distilled beverages, and this applies to molasses as well as to other food materials. Alcohol is required in the manufacture of munitions and for certain industrial purposes, and is a necessary ingredient in methylated spirits, vinegar and some drug preparations. It may not be produced legally for any other purposes. If molasses which could be refined for the manufacture of sugar or syrup is now used in the distillation of potable liquors, such use constitutes an offence against the law of Canada and is subject to heavy penalties. The Order in Council has the same effect as any other Federal law, and persons who may have knowledge that it is being violated should inform the police authorities"

The importation of spirit, during the continuance of the war, is forbidden by the Order of December 22nd, but such does not apply to sacramental wine, liquors for medicinal purposes, or for manufacturing or commercial purposes, and the same Order makes a most important and, at last, definite change in the legal meaning of the term "intoxicating liquor," which now corresponds with that for Ontario and covers any beverages, or liquor containing more than two and one-half per cent. of proof spirit. Last of all comes the intimation that in April next the privilege of shipping spirit into Provinces under temperance legislation will be withdrawn and it is also likely that the sphere of such restriction will be further extended.

It is hoped that the preceding data will be sufficient to supply the main facts in relation to the present position of the distilling industry and also afford figures for reference in the more detailed consideration of certain phases—as that of industrial alcohol—which will follow.

Clay Analysis

A departure from the usual method of conducting this analysis will adapt it to an estimation of the quartz and feldspar constituents as well as true clay. Five grms. of air dry clay are heated with successive portions of sulphuric acid (1 : 3) for an hour or two on the water bath, taken down until the acid fumes on a sand bath, and after dilution with water the contents are decanted through a filter, reserving the residue, which is treated once or twice with solution of caustic soda 1 per cent. and sodium carbonate crystals 10 per cent. in solution, again decanting, and finally washing on to a filter with dilute hydrochloric acid. The silica and quartz residue after the contents and filter have been dried, ignited, and weighed are treated similarly. The estimation of true clay by difference is achievable, and its analysis useful. The analysis of the quartz and feldspar as well as of the decanted solutions is especially valuable, as the potash should be estimated in both.—J. C. Thomlinson, B.Sc., in Chemical News, London.

Chemical Organization in British Columbia

From the Inaugural Address by J. A. Dawson, Chairman British Columbia Section of Society of Chemical Industry

"We are proud to be assembled here now at the inaugural meeting of our British Columbia Section of the Society of Chemical Industry of Great Britain. A year ago there were nine members of the Society in British Columbia. At the present time we have some forty members.

"The Society in which we are incorporated is the pioneer organization of the Industrial Chemists of the world, having been founded in 1881. If we glance over the list of past presidents, we find such famous names as: Sir Henry Roscoe, Sir William Perkin, Sir James Dewar, Ludwig Mond, Sir Edward Thorpe, Sir William Ramsay, William H. Nichols, Sir Boverton Redwood, Professor Ira Remsen, Professor Marston T. Bogert, Sir William Crookes, Doctor Charles Carpenter, and at the present time, Professor Henry Louis. There are organized sections of the Society throughout Great Britain, in Australia, Eastern Canada and in the United States. The new Bristol and South Wales section has just been announced. Now follows our own British Columbia Section and new sections I believe are being planned in India and in South Africa and another on our Canadian prairies at Winnipeg.

"We extend our greetings to the prairie chemistsand hope to welcome them soon within the British fold of chemists as a local section. It is only by such organization and co-operation of technical men that we can hope to achieve our ideals of empire and of scientific progress."

Mr. Dawson then referred to the remarkable achievement of British chemists since the war began, mentioning the re-creation of the dye and color industries, the development of gases and explosives, optical glass, immunizing sera, super-salvarsan, and the Carrell-Dakin solution, submarine detectors, wireless apparatus, and most spectacular of all, improvements relating to the construction of aeroplanes, tanks, new ships and guns. In these developments Canada has had no small share, and on this point Mr. Dawson said:

"As chemists possessing some knowledge of the great principles which underlie the transmutations of matter and of energy, our future problems and responsibilities, in this almost virgin field of resources and opportunities in British Columbia, are exceedingly great. There are great problems of research and the application of chemistry to industry as well as problems of education and organization. At the Canadian Club, the Governor General made the following statement.

"What we in the British Empire have to see to is that those resources on British soil, worked by British capital and by British labor, shall be developed in such a way that, scattered as we are, over the face of the civilized world, we shall be able to make both in times of war and in times of peace, the fullest and greatest use and get the best possible results."

"I would now refer to one or two problems of organization. In the United States the university chemists and the industrial chemists are united in one organization in the American Chemical Society. We should have the same consolidation of chemists in the British Empire. In Toronto there was established last May by private initiative, The Canadian Chemical Journal. Although I am firmly convinced of the wisdom of maintaining a strong connection with the Society of Chemical Industry and of remaining thoroughly loyal to our Journal, yet it is my humble opinion that there is at the present stage of our development, a

decided need for a Canadian Chemical publication which should be the organ of Canadian chemists, both academic and industrial. Otherwise how can we logically develop a national and a professional spirit, and also be independent of the overshadowing power of the solid organization of chemists in the United States?"

Mr. Dawson urged the formation of a legal Association of Chemists, similar to that of lawyers, doctors, dentists, etc., and referred to a movement in England with this end in view. Alluding to the difficulties of chemists in the past he gave the following account of the trials of the first chemist in Canada:

"About three hundred years ago, in 1616, a Parisian apothecary named Hebert, was induced by the merchants of Rouen, St. Malo and LaRochelle, through Champlain, to sell his house and shop and emigrate to Ludovica, now Quebec city. He was to receive 200 crowns a year for three years. After he had committed himself and had started on his journey, the company beat him down from 200 to 100 crowns a year and forced his family and servant to work entirely for the company. Even at the end of three years when he found himself at liberty to till the soil, he was bound to sell his produce to the company at the prices prevalent in France. The company was to have his perpetual service as a chemist for nothing and he must promise in writing to take no part in the fur trade. A man of honor like Champlain could not have tricked Hebert into the bad bargain he made and their friendship survived the incident. Hebert was the first to make a clearing on the heights. His first domain covered less than ten acres but it was well tilled. He built a stone house which was 38 feet by 19. Besides making a garden he planted apple trees, vines, etc. He also managed to support some cattle. When one considers what all this means in terms of food and comfort, it may be guessed that the fur-traders wintering below on salt pork and smoked eels must have felt much respect for the chemist and the farmer in his stone mansion on the cliff. Champlain's dream is disclosed to us as follows: A city at Quebec named Ludovica, a city equal, in size to St. Denis and filled with noble buildings grouped round the Church of the Redeemer. Tributary to this capital was a vast region watered by the St. Lawrence and abounding in rolling plains, beautiful forests and rivers full of fish. From Ludovica the heathen were to be converted and a passage discovered to the East. So important a trade route would be developed, that from the tolls alone there would be revenue to construct great public works. Rich mines and fat cornfields fill the background. Such was the Quebec of Champlain's vision—if only France would see it so! But in the Quebec of reality a few survivors saw the hunger of winter yield to the starvation of spring. They lived on eels and roots, till June should bring the ships and food from home.

"Let us now turn to our Pacific coast. It is some two hundred years later that John M'Loughlin was sent by the united Hudson's Bay and the North West fur companies to rule over the vast territory of original Oregon. He established Fort Vancouver on the north bank of the Columbia river near the Willamette. John M'Loughlin was a Canadian, born at Riviere du Loup and he had studied medicine at Edinburgh. The Indians called him "White Eagle," from his long snow-white hair and aquiline features. One of the first things he saw was that it would be quite possible to raise food for his men on the spot instead of transporting it over two watersheds and across the width of the continent. He sent men overland to the Spaniards of lower California to purchase seed-wheat and stock. About the time his wheat fields and orchards began to yield, some passing ocean traveller asked him, "Do you think this country will ever be settled?" "Sir," answered M'Loughlin, emphasizing his words by thumping his gold-headed cane on the floor, "wherever wheat grows, men will go, and colonies will grow." Afterwards when he had to choose between loyalty to his company and saving the lives of thousands of American settlers who had come over the mountains destitute, these words of his were quoted against him. Just as Champlain had his dreams, so M'Loughlin endeavored to hold the whole of the North American Pacific coast for the British Empire. California, Oregon, Alaska and even Hawaii might easily have become British territory. But the directors of the fur companies in London and the British Government could see nothing beyond furs and the fact that they had held Rupert's Land for over 200 years without a garrison. Oregon was eventually owned by settlement and the settlers threatened to burn the fort about M'Loughlin's ears. In 1844 he retired in disappointment and cast in his lot with the Americans. It was only the development of trouble with Mexico that saved New Caledonia, now British Columbia for the British, otherwise the cry of 54-40 or fight might have shut Canada entirely out from an outlet on the Pacific ocean. It is just fifty years ago that Vancouver Island and the mainland were united under one government as British Columbia.

"To-day we are living in the reality that was the dream of pioneer explorers who have passed. And now the cult of the alchemist has been established here in the far West on the Pacific border of Canada. Just as men of earlier days labored towards a vision, so may we allow our imagination to spur our activity. First let us conceive one Empire-wide organization, known as the British Chemical Society which shall include both the so-called academic and industrial chemists. We are all striving to acquire new knowledge. The academic discovery of yesterday is to-day applied to industry, and the industrial problem of to-day is the academic research of to-morrow.

"The war has crumbled many walls and eliminated decadent traditions of irrational prejudice. Surely then we are not over sanguine if we look for the speedy consolidation of British chemists. The equilibrium between superstition and civilization is not static but dynamic. The rate of the reaction can be catalyzed by the application of the rational scientific spirit.

"La critique est la vie de la science!"

Chemistry in Canadian Industry

A Timely Note from Dean Goodwin Endorsing the Convention of Canadian Chemists

Editor, Canadian Chemical Journal:

Sir,—It has been suggested that in May next there should be a general convention of Canadian chemists in connection with a meeting of the Society of Chemical Industry in Ottawa. The importance of chemistry to the industries is a subject of such great importance that we should seize upon every opportunity to urge it upon public attention.

There are very few manufactures now which do not involve at some stage or another the use of chemical processes or chemical analysis. A country which is slow to realize and take advantage of this fact cannot fail to drop behind in its manufacturing industries. For rapid advancement, the curtailment of waste, and the scientific control of the quality of the products, Canada needs to pay a great deal more attention to chemistry and particularly to Research in Chemistry. The effect of a meeting such as proposed can be made very great and far reaching, for there may be gathered together the professors of chemistry from the colleges and universities, the chemists who are at work in the industries, and others whose field of service is in the Civil Service. Discussions and consultations among these three bodies of men will surely bear fruit.

There are very important and pressing problems facing us just now, such for example as the promotion of intensive agriculture. A discussion of these from the standpoint of the chemist may lead to important action which will be far reaching in its results. It will be particularly opportune for such a meeting to be held in the Dominion Capital.

Yours sincerely,

W. L. GOODWIN.

Queen's University, Kingston,
February 4, 1918.

Notes from New York.

By F. M. Turner, Jr.,

(Correspondence of The Canadian Chemical Journal)

The principal event in chemical circles here in January was the meeting of the dyestuff manufacturers to form a Dyestuff Manufacturers' Association.

The need for such a conference and the formation of such an organization is suggested by the sudden and great growth of the manufacture of synthetic dyes in America. To-day there are over three hundred manufacturers of these dyes in America. In Germany, where the industry has long been established, less than twenty concerns held the field and dominated the trade of the world in this line. It was evident to everyone that if the American manufacturers were to hold their own after the present abnormal conditions have passed away considerable team-work and mutual consideration of the interests of the manufacturers, the dealers and the consumers would be necessary.

After considerable discussion, it was decided to form an association, the manufacturers to be full members and to dominate the organization. The dealers were to be admitted to associate membership.

The association will probably incorporate under the name of "The Dyestuffs Association of America." Temporary officers were elected as follows: Chairman, Frank Hemingway, New York; secretary, C. Cyril Bennett, New York; treasurer, C. D. Jenkinson, National City Bank, New York; organization committee, Dr. J. Merritt Matthews, New York; L. A. Ault, Cincinnati; August Merz, New York; W. S. Woodward, T. N. Hyndman, H. Gardner McKerrow, S. David.

It is understood that the next meeting will be held at the Chemists' Club on March 6th. Over one hundred persons were present at the meetings, out of two hundred invited by Mr. McKerrow, of E. F. Drew & Company, New York, who gave the first address. After explaining the objects of calling the conference, Mr. McKerrow went on to speak of "Standardization," the chief topic to be considered by the meeting.

He stated that almost all the replies to the original letters he sent out asking for an expression of opinion on this subject were such as to indicate that manufacturers would be in favor of some system of standardization of dyes in America. However, some people characterized the idea as "an iridescent dream" far beyond the reach of present possibilities. Others thought that it would lead to such complications as would make it impossible of fulfilment. Still others, however, thought that it was perfectly feasible if approached in the right spirit.

The opposition may be roughly divided into three classes. First, there are those who honestly believe that it cannot be done. The answer to this is that it was done by the German manufacturers. Moreover, they did it in the face of difficulties greater than any we have to face. In America there are less than one hundred different aniline colors made to-day, and these are simpler than the German colors. The standardization of the German dyes had to include more than one thousand colors, and these of a high degree of complexity, and with many mixtures and shades.

Whether perfect standardization is possible or not, the association ought to be able to "register" the types of dyestuffs made by American manufacturers. This would afford public information as to the types and strengths of dyes these makers intend to follow. Standards could be publicly filed and samples submitted could be compared with them.

Some offerings might run ten or even twenty per cent. higher than this standard, in which case the material would be worth relatively more money, while other offerings might be ten or 20 per cent. below the standard, in which case the manufacturer would be impelled to improve his method of production so as to reach the trade standard. It is necessary to the purposes of the United States Government that some form of standardization should be adopted for assessing duties on imported colors. Wherever this duty takes the form of a specific rate—that is to say, an impost of so much per pound—the question of the degree of concentration is immediately raised. There must be a starting point which the Government can adopt and against which importations can be compared. It has been shown by past experience that dyestuffs can be imported of four and five times the concentration of ordinary recognized trade standards, and yet these importations carry no higher specific rate per pound than the trade standards as recognized before the war, thus defeating a very large proportion of the protective intent of the act. It is certain that if the dyestuff industry does not devise some means of standardization which the Government can adopt, an attempt to do this will be made by the Bureau of Standards in Washington.

Mr. A. E. Parker spoke on British and American patents, giving special attention to the licensing of companies to operate enemy patents, as has been done in England and as it is proposed to do here.

Three resolutions were adopted: The first in favor of the proposed standardization; the second asking for more adequate tariff protection, and the prohibition of the entry into the country of foreign goods below a fair market price. Congress was asked to continue specific protection till after the restoration of normal conditions in peace time.

The third resolution was as follows: "This Convention believes that the United States Government should exercise great care and discrimination in requiring the services of trained chemists and chemical specialists for military service. In view of the fact that the dyestuff industry is so closely allied to the munition industry, the services of these chemists and specialists are of infinitely more value to the country when they are devoting their special training and knowledge to the production of their specialties than they would be in ordinary military functions which call for no special technical equipment."

On January 18th the Society of Chemical Industry met at the Chemists' Club to confer the Perkin medal of the society on Dr. Auguste J. Rossi, for his work in developing the metallurgy and commercial application of titanium. The work of Dr. Rossi was reviewed by Dr. F. A. J. Fitzgerald, of Niagara Falls, N.Y., a former president of the American Electrochemical Society. Dr. Wm. H. Nichols, of the General Chemical Company, a former President of the Society of Chemical Industry, presented the medal. Dr. Rossi replied. Following this meeting took place the organization of the New York Section of the Societe de Chimie Industrielle of France. This society is to promote intimate relations between French and American chemists. Dr. L. H. Baekeland was elected president. Dr. Jerome Alexander spoke of the achievements of French chemists and the warm feeling that existed in the country towards France.

Separating Nickel from Copper

Through Messrs. Ridout & Maybee, patent solicitors, Toronto, a patent has been granted to G. A. Guess, M.A., of Oakville, Ont., professor of metallurgy in the University of Toronto for a "Process of Electrolytically Separating Nickel from Copper." The object of the process evolved is to avoid the complications and expense which arise through the tendency of copper to re-deposit with the nickel in the metallurgical process of the electrolytic recovery of nickel and copper from copper-nickel ores by the use of anodes of copper-nickel in an electrolyte of nickel sulphate. The method consists in suspending pulverized calcium carbonate in the electrolyte (heated to 60° to 80°C.) by agitation and shielding it from contact with the cathode by means of a porous cell. The copper dissolving from the copper-nickel anode is precipitated as carbonate or hydroxide, the calcium as sulphate and the nickel alone is deposited on the cathode.

Water Sterilization Without Chemicals

By W. R. Ostrom, Northern Electric Company, Toronto

This article at first glance would appear to have no place in a Chemical Journal. It is, however, inspired by the excellent treatise of Joseph Race, F.I.C., in the January issue of The Canadian Chemical Journal on the Ottawa Water Supply.

Mr. Race touches a specific case from a chemical and bacteriological standpoint. This article applies generally to all cases from an "Energy Radiation" and bacteriological standpoint.

It is proposed to show that "Energy Radiation" can ultimately take the place of chemicals to make water absolutely sterile.

The writer assumes a general knowledge among all chemical engineers of the difference between Potential and Kinetic energy, and will therefore only consider the latter manifestation of energy which directly concerns the sterilization of water, i.e., the process of radiation. (1) It is well known that "radiators" have been constructed capable of throwing off white light at a temperature of 5,000° C., which contain not only all the wave lengths of the spectrum, but when analyzed show many more which are so high and short in their length and frequency per second that the human eye is incapable of detecting them. (2) These invisible, enormously fast, and short radiations are called ultra Violet, (3) and represent a far larger proportion of all the radiations given off by a "black radiator" brought to a temperature of 5,000° C. than do the visible rays. There is, of course, more power in the long visible heat rays (infra red class) than in the rapid short amplitude waves. These rapid short amplitude waves, however, have some exclusive qualities not possessed by the infra red rays, which are well known to chemical scientists and utilized commercially. In photography for instance the ultra violet rays (sometimes called "actinic") through their chemical action deposit the proper ingredients on the plate or film so that there is a distinguishable reproduction of the object photographed. Of course visible rays also assist in photography. It is these ultra violet rays that have been progressively experimented with (4) and have finally been successfully and commercially applied as a bactericidal agent (5).

A commercial apparatus has been successfully developed in which the ultra violet wave length is .2 of 1/1000 of a millimeter, and experiment has demonstrated that this is the wave length of the radiation which it is desirable to secure in order to make water absolutely sterile. The energy exerted by this particular wave length will destroy all minute forms of animal and vegetable life. This destruction of bacteria and bacilli can be watched by the doubting ones by means of a suitably designed apparatus which throws pictures of the germs in sufficiently enlarged proportions upon the ordinary magic lantern screen, and as the micro-organisms pass to and fro in the ordinary ways of their existence, radiations of the ultra violet rays are mechanically caused to strike them. They immediately swell up and burst, and the constituent parts of which they are made are dissolved, destroying all possibility of life and reproduction of the protoplasm. Exhaustive tests have proven decisively that the bacteria are killed by the ultra violet rays directly, and not through oxidation by chemicals formed by contact of the rays with the water. The fact that there is no possibility of reproduction of the bacteria is forcibly demonstrated in the effect of ultra violet rays on toxins. Toxins are frequently an immense aggregation of dead bacilli in fluid, and even though the life of the micro-organisms in the toxin is extinct, they generally produce certain marked effects in the human body after inoculation. If, however, these toxins are subjected to the radiations of the ultra violet ray, the poisoning power of the toxin seems to disappear. Science recognizes this as substantiated fact, but has not yet discovered an explanation.

Among the bacteria which have been exterminated by the apparatus above mentioned are (6):

Staphylococcus aureus	approximately	11	seconds.
B. Cholera	"	18	"
B. Typhoid	"	19	"
B. Dysentery (Shigo)	"	18	"
B. Dysentery (Dopter)	"	17½	"
B. Coli	"	19	"
Aerogenes Capsulatus	"	31	"
B. Tetanus	"	40	"

These bacilli are all water-born and their presence in the human body often means serious illness or even death and sometimes a dangerous epidemic. All scientists know when B. Coli (which of course are harmless and necessary bacilli for the proper functioning of the digestive organs) are found in drinking water it is an immediate warning signal that the water is polluted, probably by human excrement. As a consequence public bodies set up expensive and manually operated chemical plants and filtration beds for treating the water. The taste and color of the water is constantly liable to change, its aesthetic and palatable qualities often destroyed, and the amount and kind of chemicals to admix with safety and security such as chlorine and chloramine and kindred germicides is at best an expensive experimental guess, and varies constantly with the bacteria count and other external conditions in the water supply.

On the other hand there is now nothing experimental, uncertain. or unduly costly in the sterilization of water by the ultra violet ray. Many plants have been in successful operation for some time, the larger public water works plants principally in Europe. The City of Genoa, Italy, has an ultra violet ray plant capable of purifying 19,000,000 gallons of water per day. The steamer "Rochester" now wintering near Sarnia, Ontario, has just been equipped with a plant to purify the drinking water taken on board from rain, rivers and lakes during its trips. A great many swimming tanks (than which there is no greater source of contamination because of the constant danger from the effluvia and emanation of diseased perspiring bodies and their sexual organs) Y.M.C.A., Sanitoriums, bottling and artificial ice manufacturing works, public buildings, hotels and water works systems in the United States, have, in the last few years, successfully adopted this means of protecting the public health.

Commercially the apparatus is a device in which the radiations in tremendous quantities are produced by means of passing an electric current through mercury vapor (7) which in a Quartz lamp is brought up to a very high temperature and gives off visible and invisible radiations which are, as shown, positively germicidal. The lamp containing the mercury is of Quartz instead of ordinary glass (8) since ordinary glass will not withstand the necessary heat nor will it permit the ultra violet radiations to pass through it without impairment. Surrounding the lamp is another cylinder, also of Quartz, into contact with which water to be purified is brought, permitting the ultra violet ray to permeate the water, reaching the bacilli and causing their instant destruction. One of these machines was in operation last August at the Toronto Exhibition and in September last at London, Ontario, Exhibition.

To those who have a knowledge of the laws of operation of the ultra violet ray it is obvious that the water to be sterilized must be free from all foreign substances which may be held suspended in it. Otherwise the particles that make the water turbid intercept the ultra violet radiations and prevent them from destroying the bacilli lurking behind the foreign bodies. Such water must therefore be filtered, after which it will be in the proper condition to be treated, regardless of its temperature or physical condition. In fact bacilli have been detected in ice and their death accomplished by the application of the ultra violet ray.

A great educational propaganda remains to be carried on among the scientific bodies, the medical profession, public health authorities, and the general public, so that drastic legislation will limit the number of B. Coli allowable per 1 c.c.

of water, for drinking, culinary and medical purposes. When such legislation is enacted the writer ventures a prophecy that the lurking danger in man's greatest necessity—water—can be overcome with absolute certainty by the successful application without chemicals or chemical action, of the Ultra Violet Ray (9).

(1) Downs and Blunt (1878) Re use of light for water sterilization.

(2) Vide research and experiment in development X-ray and Roentgen Ray and Violet Ray.

See Modern Illumination—Horstmann & Tousley.

See Radiation, Light and Illumination—C. P. Steinmetz.

(3) Henri and Helbronner at Sorbonne University, Paris.

(4) DeMare's Water Sterilization with Cooper Hewitt lamp. Courmont, Nogier, Vallet et al. forms of sterilizers employing Mercury Vapor Arc Lamp.

(5) Von Recklinghausen et al.—Sorbonne University, Paris. R.U.V. Co. Incorporated, New York, N.Y.

(6) Seconds necessary to kill different types of germs at 200 m.m. from a Quartz lamp burning at 66 volts 3.5 amp. R.U.V. Co.

(7) E. N. Hyde, Montreal.

(8) See construction Peter Cooper Hewitt Mercury Vapor Arc Lamp.

(9) Ultra Violet Rays—

The Invisible rays of a source of light that are shorter than the Violet Rays.

The shortest rays that are visible to the eye are the Violet Rays.

The Chemist and the Lawyer

Editor The Canadian Chemical Journal:

Sir,—Below are extracts from a public notice by the Civil Service Commission calling for applications for the position of a lawyer and a chemist. For convenience of comparison the two requirements are here placed in parallel columns:

The Civil Service Commissioners hereby give public notice that applications will be received from candidates qualified to fill the following positions in the Inside Division of the Civil Service of Canada:

1. A Legal Officer to be appointed to one of the departments in Subdivision A of the First Division, at an initial salary of **$3,300** per annum. Candidates must be at least twenty-eight years of age, must have had a few years' practical experience in law and must possess a good general education.	2. A Chemist for the Fuel Testing Division of the Mines Branch of the Department of Mines, Subdivision A of the Second Division, initial salary **$1,600** per annum. Candidates must have a thorough training in Chemistry and Physics and hold a degree from a recognized university, should have proved their ability to take out original research, and have had subsequent experience in practical Chemistry. They must be thoroughly familiar with the methods of gas analysis where great accuracy is required, and must be capable of testing the methods and calibrating the apparatus used in their work.

The contents of this notice should be brought to the attention of all Canadian chemists. How is it that a member of the legal profession with a "few years' practical experience in law" based upon a "good general education" is worth $3,300 to the country, while a chemist holding a "degree from a recognized university" having a "thorough training in chemistry and physics" having "proved his ability to take out original research" and other requirements calling in effect for a well trained physical chemist, is worth less than half that sum? Such a discrepancy between emuneration and training in our civil service does not reflect creditably upon chemists, at least in the estimation of the Civil Service Commission. How can the Civil Service expect to uphold the efficiency of the staff of chemists employed in its many branches or to aid in the development of the resources of the Dominion when such a discrimination in remuneration for trained chemists exists. If training and experience are criteria for the value of service, then it is our opinion that the salaries in the above circular should be transposed.

J. W. SHIPLEY.

Department of Chemistry,
Manitoba Agricultural College,
February 6, 1918.

Canadian Textile Institute

The first annual meeting of the Canadian Textile Institute was held on January 26th at the Engineers' Club, Toronto. Mr. C. M. Heddle, of Penman's Limited, Paris, Ont., was in the chair. A large number of delegates were present representative of the Canadian textile industries.

This Institute, organized in March last, has already taken a big step toward the advancement of the textile industries of this country. It is a well known fact that the high stage of development reached in the textile industry in such countries as Great Britain, the United States and Japan has been dependent upon technical training. The Canadian Textile Institute has taken steps looking to the establishment on a better foundation of such technical instruction in this country. A resolution to this effect and authorizing the newly appointed executive council of the Institute to endeavor at once to obtain the co-operation of the Federal and Provincial Governments was unanimously adopted, and the committee will urge upon the Governments the importance of the textile industry in its relation to the various agricultural interests such as wool growing, flax raising, etc.

The following were elected members of the Executive Council: C. W. Bates, Carleton Place, Ont.; I. Bonner, Paris, Ont.; F. G. Daniels and A. O. Dawson, Montreal, Que.; F. B. Hayes, Toronto, Ont.; F. R. Moodie, Hamilton, Ont.; Edgar Worth, Peterborough, Ont. The chairman of each local branch of the Institute is, ex-officio, a member.

Mr. Alfred Burton was appointed permanent secretary of the Institute. No man better qualified to fill this rather arduous position could have been found. Mr. Burton has had wide experience not only in the textile and its allied industries, but also in the establishment of technical organizations such as the Canadian Section of the Society of Chemical Industry. The offices of the Toronto Branch will be at 614 C.P.R. Building, Toronto.

Ammonia and Ammunition

Owing largely to the demands for war purposes there is now a shortage of 60,000,000 pounds of ammonia per year in the United States, and a corresponding shortage in Canada. By storing all the natural ice possible to harvest, ice companies, farmers, creamery owners and others will help materially in saving ammonia this year, and this will leave more for the war industries for which it is in great demand. Because of this war demand for ammonia, the utmost economy is necessary in referigeration. Those who use ammonia for cold storage should stop immediately all chemical loss in their plants; have a chemical analysis made of circulating liquid to lessen corrosion; return at once all empty cylinders and containers to supply firms and utilize and store natural ice to the greatest possible extent.

J. S. N. Dougall, president of the Dougall Varnish Company, Montreal, died at his home last month. He was born in Montreal, and had for many years been prominent in the varnish industry of Canada. He had been chairman of the Montreal branch of the Canadian Manufacturers Association.

Milk Powder—Its Manufacture and Uses

(From a paper presented before the Toronto Section of the Society of Chemical Industry, by S. B. Trainer, secretary-treasurer of the Canadian Milk Products, Limited, Toronto, Ont.)

The writer refers to the prevailing idea among most people that "Milk Powder" is nothing more nor less than a composition of various chemicals to produce a product that can be used as a milk substitute and he proceeds to show how erroneous this view really is. Reference is made to the fact that, from the point of view of food value, milk is the leading daily food of the world, and to the statement made recently by Dr. Hastings, the medical health officer of Toronto, that even at the advanced prices milk, in food value, is the most economical article of diet we possess and that, taking the City of Toronto as an example, the consumption per person, slightly over one-half pint, is only one-third to one-half what it should be.

Chemical analyses of liquid whole milk or full cream milk as it is also described, liquid separated or "skimmed" milk, whole milk powder and separated milk powder are given as follows:

	Liquid Whole Milk	Liquid Separated Milk
Water	87.50%	91.00%
Fat	3.50	0.03
Milk Solids	9.00	8.97
	Whole Milk Powder	Separated Milk Powder
Casein	20.99%	29.90%
Albumen	4.01	8.70
Milk Sugar	38.10	50.90
Fat	28.83	0.32
Ash or Salts	6.13	8.53
Moisture	1.94	1.65

The advantages of milk in a dry stable form arise from the very perishable or unstable nature of liquid milk and also from the ease with which impurities and disease germs can be carried by milk in the liquid form.

The process of converting liquid milk to solid milk, which is that involved in the production of milk sugar should prove of considerable interest to technical chemists as well as to those interested in the milk business in its many branches.

Drying milk in a crude way has, of course, always been possible, but it is only within the last fifteen or twenty years that processes have been developed which have made the production of dry milk a commercial proposition.

In the early days of experimenting various methods were used, but the first practical commercial method evolved was that known as the "Roller process," and this process is still in use to a greater or less extent in all countries. In the original method fresh liquid milk was poured in streams upon the surfaces of steel rollers revolving in opposite directions and against each other, the rollers were hollow and heated with live steam and adjusted to allow a thin film of milk to pass between them, a perfectly even film of milk solids would be left on the cylinder which was scraped off by means of knives set against the upper surface of each roller. The product was a fair quality of milk solids or milk powder.

In recent years the process has been made more economical and more practical commercially by partly concentrating or condensing the milk before passing it to the rollers, and the product has been made more satisfactory for commercial uses by the use of a sifting machine to make it more uniform.

The first commercial drying of milk in Canada was accomplished in 1903 by Mr. B. A. Gould, now president of Canadian Milk Products, Limited. A cheese factory was converted into a crude milk drying factory and these roller process machines were used exclusively for producing milk powder.

Milk powder produced by the roller process is not entirely soluble in water, the extreme heat necessary in the process changes the physical and chemical composition of the milk ingredients to such an extent that the solids produced cannot be restored to their original physical and chemical composition, and it was known and appreciated that if milk could be dried and be in a condition from which it could be changed into the original fresh liquid milk its commercial use would be increased many times. Previous to 1909 efforts were put forth by the Canadian Milk Products, Limited, of Canada; the Merrel-Soule Company, of Syracuse, N.Y., and by Truford, Limited, of England, to produce a milk powder entirely soluble in water.

It was understood that to produce a soluble powder evaporation would have to be effected at a temperature sufficiently low to avoid any change in the chemical composition of the milk solids. Experiments were conducted along the lines of evaporating by means of heated dry air, and it was found that by spraying or atomizing the liquid milk into dry air, thus subjecting to the largest amount of evaporating surface, the milk solids and the moisture could be separated so as to leave a dry product. Finally in 1909 a complete Spray process of milk drying equipment was developed and in that year the Canadian Milk Products, Limited, installed machinery and equipment to dry milk by this spray process.

This is really the starting point of the production of milk powder so far as having a product for all milk uses is concerned, and the spray process is in use in all countries and produces a product absolutely soluble in water giving a solution that is like the original fresh liquid milk.

In connection with the business of the Canadian Milk Products, Limited, it may be mentioned that the company has plants at Brownsville, Belmont, Burford and Hickson, Ont., and milk receiving stations at Glanworth, Harrietsville, Corinth and New Durham. The Belmont plant was built and equipped in 1912 at a cost of over $100,000; the Burford plant was built a year ago and the Hickson plant was completed this year. 25,000 gallons of milk are handled daily in the summer and 15,000 in the winter. All the farms supplying milk are covered by regular inspection as to health and care of cattle, sanitary conditions of stables, yards, utensils and the milk itself.

No milk is accepted of a temperature higher than 65°F. This rule forces the farmer to cool his milk in summer immediately after milking.

Treatment and Process at the Plant

Upon receipt at the plant the milk is pasteurized, the custom being to hold the milk at 155°F. for twenty to thirty minutes. After pasteurization the milk passes by sanitary pipes to the condensing machine or "vacuum pan"—a large copper tank holding 1,200 to 1,500 gallons, steam jacketed and fitted with air-tight condensing chamber and vacuum pump. By this means the milk is reduced in volume at a temperature low enough, namely 125° to 130°F., to avoid changing the chemical composition of the solids, which would result from the higher temperature necessary were no vacuum system employed. This is called the "batch" pan method which signifies an intermittent process. Apparatus is being developed experimentally whereby it is expected that a "continuous" vacuum process will be commercially possible. Any effect that is made upon milk in this part of the process shows in the finished product.

Whole milk is precondensed by this process in the ratio of 2½ to 1 and separated milk in the ratio of 4¼ to 1.

This concentration of the milk is done for the reason that it cuts down the total cost of production considerably; without this saving in cost milk drying would not be commercially profitable. It is also claimed that a superior powder is produced.

From the condensing pan the milk is collected in sanitary tanks and passes from these through a sanitary pipe to the "spray box." Filtered, heated, dry air circulates continually through a so-called "dry box," and into this circulation of air the milk is atomized. The instant the dry heated air comes in contact with the thin atomized film of milk the moisture is taken up and the milk solids fall by gravity like flour or snow or pulverized sugar to the bottom of the drying box or unit.

For this part of the process large boiler capacity is required for steam production, steam heated coils for air heating, mechanical filters for air filtering and fans for circulating the air.

Several drying boxes or units are in operation at each plant, and are equipped with special apparatus to avoid any loss of milk powder in the air current.

The final part of the process is that of collecting the dry milk solids in sanitary cans and packing in sanitary containers adapted for particular users.

The entire process is completed within a few hours and when the precondensing is done by the continuous method can be completed in thirty minutes.

Qualities of Milk Powder

Chemically, milk powder is pure, that is to say, there are no preservatives, chemicals or adulterants of any kind used in the process of making it. Dr. A. McGill, chief analyst, Inland Revenue Department, has given analyses of several of this company's products in Inland Revenue Bulletin No. 257 and states that milk powder is "genuine and true to the claims made for it."

Milk powder, through pasteurization, is free from disease producing bacteria and so long as it is kept dry will keep indefinitely so far as multiplication of bacteria and the souring of the product is concerned. When dissolved in water the same conditions will apply as apply to liquid milk. Whole milk powder, however, which contains the fat of the milk, will not keep indefinitely, for the reason that the acids of the butterfat will, in the course of a few weeks, under ordinary storage conditions, begin to oxidize, and the buteric acid element breaks down and causes rancidity. In cold storage this powder will keep in perfect condition for months.

With regard to the so-called "life" in milk due to the enzymes—the "life" is not affected by pasteurization but is destroyed by sterilization. It is claimed, and shown by means of the Leffman test that the spray process in no way affects the enzyme life and the product is in perfect condition so far as this essential quality is concerned.

In comparing milk powder with "condensed" and "evaporated" milk, mention is made of condensed milk being produced by removing a part of the moisture, then adding sugar as a preservative and its being processed at a high temperature for two to three hours—evaporated milk being the same only unsweetened. It is stated that this process destroys the enzyme life of the milk and also changes the chemical condition of the solids rendering the casein insoluble, the albumen coagulated and insoluble, the milk sugar broken down and the carbonates and salts changed chemically, making it impossible to restore these products to their original condition.

The Uses of Milk Powder

With reference to the products of Canadian Milk Products, Limited, their whole milk powder, "Trumilk," has a big field in milk chocolate manufacturing, and is used also in biscuit, creamery and dairy work. One milk chocolate manufacturer alone uses $10,000 worth of this powder per month. Giving the confectioner or baker his milk without water solves his most serious problem. The old roller process whole milk powder is preferred by some companies for milk chocolate making. This makes a coarser grained chocolate, but requires less coco butter to work out the butterfat from the powder.

Trumilk sells in barrel quantities at 32 to 35 cents per pound, mixed in the proportion of 1 pound powder to 7 pounds water it produces the original whole milk.

The separated milk powder—"Milk stock," containing little or no fat, is largely used in baking and biscuit manufacturing. The biscuit maker produces several different kinds of goods, each with its particular amount of milk and fat. He prefers to have his milk without the fat so that he can vary the total quantity of fat at will, hence his demand for separated milk powder. This sells at 20 to 24 cents per pound.

In the ice cream industry milk stock is coming into general use in supplying the solids of the ice cream. By using fresh unsalted butter, milkstock and water, a liquid cream can be produced which can be used for all cream purposes, hence its importance to the ice cream manufacturer especially when he cannot get his usual supply of liquid cream. Milk stock is also used as a lactic acid bacteria culture in culturing cream for butter making, and in producing buttermilk, by culturing in this way.

The cream powder, "Trucream," is used almost exclusively by ice cream manufacturers during the shortage of cream in the summer and in fine caramel work. It sells at about 55 cents per pound.

Modified milk and sweet whey powders make specially valuable infant and invalid foods. It is claimed that the former is the only all milk absolutely soluble baby food produced. Sweet whey is chiefly albumen and milk sugar and modified milk powder is made by combining specially selected whole milk powder with sweet whey powder in certain proportions.

"Klim"

In analysis Klim is the same as milk stock but it is a superior product from the point of view of domestic use. It is only since the company's plant at Burford was completed that they have been able to produce a product which when dissolved again has the same flavor as the original milk. This quality is claimed for their product, "Klim." Klim retails at 35 cents per pound or $3.00 per 10 pounds, which furnishes milk at 7½ to 9 cents per quart. Figures are given to show that the 1½ ounce of butterfat contained in a quart of whole milk really costs $1.10 a pound, with milk at 13 cents a quart and it is shown from the analysis that from the standpoint of body building food separated milk is more valuable and economical for household use than liquid whole milk.

In conclusion the writer points out that milk powder can be made to fill all milk wants, that it can replace the liquid milk business of cities, that it can accomplish everything that condensed milk accomplishes, that it is a food product more valuable than cheese and butter and that, all things considered, it will bring a larger return to the milk producer than will any of the other industries dependent upon milk production.

War Trade Board for Canada

A War Trade Board has been created by the Dominion Government for the purpose of more effective industrial organization for war purposes. The members of the Board are: Sir George Foster, Minister of Trade and Commerce, who has been appointed chairman; Frank P. Jones, Montreal; John W. McConnell, Montreal; James H. Gundy, Toronto; Charles B. McNaught, Toronto; Joseph Gibbons, Toronto, who will represent organized labor; C. A. Magrath, fuel commissioner; and the Hon. H. Laporte, chairman of the War Purchasing Commission, are exofficio members.

Among the various powers and duties of the board are the following:

To undertake and carry out such supervision as may be necessary of all industrial and commercial enterprises, and by co-operation with producers to prevent waste of labor, of raw materials and of products.

To make recommendations for the maintenance of the more essential industries as distinguished from those of a less essential character.

To investigate and keep records of the country's stock of raw materials, partly finished products and finished products.

To consider and recommend methods of curtailing or prohibiting the use of fuel or electrical energy in the less essential industries.

To investigate generally conditions of trade, industry and production (except food production), and to make recommendations with regard thereto.

Society of Chemical Industry

Ottawa Branch

A meeting of the Ottawa Branch of the Society of Chemical Industry was held on January 31st in the Carnegie Library. About forty members and their guests were present, Dr. A. McGill presiding. Dr. McGill informed the meeting of the approval of the members of the Toronto and Montreal branches of the suggestion that the annual meeting of the Section be held in Ottawa toward the end of May and that an endeavor would be made to hold a convention of chemists of the Dominion at the same time.

The meeting was addressed by E. Stansfield, D.Sc., on the "Fuel Problem from the Chemist's Viewpoint." Dr. Stansfield referred to the fact of Canada's total production being less than one-half the amount consumed and of which only one-sixth is hard coal, the balance, about 25 million tons, being soft coal, and expressed the opinion that our coal deposits being part of the capital of the Dominion should be conserved and the use of uncarbonized coal prohibited. Brief mention was made of the various processes used for the carbonization of coal and the production of various gaseous fuels, and particular attention was given to the carbonization of the lignites of Western Canada which are now being investigated by the Fuel Testing Station at Ottawa.

In the first experiments on these lignites very small charges were used and every precaution taken to obtain accurate temperature control. In the second series the charge was increased to 1 kilogram and complete analyses were made of the coke, gas, liquor and tar. Some of the results obtained were tabulated and presented to the meeting. On the completion of this series it is intended to carry the experiments to the semi-commercial scale and to endeavor to find a suitable process for producing briquettes from the carbonized residue.

Dr. Stansfield expressed the opinion that the commercial utilization of the country's large deposits of low grade non-coking bituminous coals will depend upon the results of intensive work by the chemist and the engineer and it is hoped that the Government will provide facilities for more vigorously attacking this problem so that its solution may not be indefinitely postponed.

An interesting discussion followed in which Drs. McGill and Shutt, and Messrs. Wardleworth, Gilmore, Hinde, Blizzard, Connor and Race took part. One member referred to the very inferior quality of the coal now marketed and cited an instance in which several car loads could not be burnt and were finally dumped as road ballast. Mr. Blizzard mentioned the very low efficiencies obtained with our present methods of consuming fuel and suggested the possibility of establishing central carbonization plants which would produce gas suitable for heating purposes.

A hearty vote of thanks was tendered to Dr. Stansfield and at the close of the meeting it was suggested that there should be a symposium on the fuel problem at the May meeting.

JOSEPH RACE, F.I.C.,
428 Slater Street, Ottawa. Secretary.

Toronto Section

A meeting of the Society of Chemical Industry, Toronto Section, was held in the Engineers' Club, on the the 22nd February, Mr. S. B. Chadsey in the chair. There was a large attendance of members.

Mr. Burton, secretary, reported that the annual meeting of the Joint Committee on Technical Organizations would hold its annual meeting about the end of March and it would be advisable to re-elect a delegate from this Society. On motion of Mr. M. L. Davies, Mr. E. P. Mathewson was re-elected delegate at large.

Dean Ellis, University of Toronto, reported that the chairman of the War Mission, had requested President Falconer to nominate a capable scientist to act as chemical advisor on the new board at Washington, and Professor J. Watson Bain had been recommended and accepted. Dean Ellis expressed his gratification that a man of the knowledge and sound judgment of Professor Bain had been sent to fill this important post, though he would be sadly missed in the university.

The chairman said the occasion should not be allowed to pass without acknowledging the great service that had been rendered to this Society by Professor Bain, whom the members had learned to love as well as to honor.

Dr. M. C. Boswell then read the paper of the evening, on "Agricultural Chemistry," in which he traced the long toils of men of science in the past in their attempts to wrest from Dame Nature the secrets of plant life, only to find themselves the victims of a flirtation. Even to-day, with all the advantages of accumulated knowledge and experiments involving enormous labors, the fundamental principles of plant growth remain among the mysteries. He dealt with the four problems of drainage, cultivation; fertilization and agricultural economics, giving much information on the famous experiments at Rothampsted, England, covering the past sixty years. He emphasized the present need in Canada of those original investigations which could best be carried out as national undertakings. The time had come when public men should realize that without more scientific agriculture Canada would drop behind.

Dean Goodwin, of Kingston, regretted that through delay in the train service he only heard the last passages of Dr. Boswell's paper, but that was enough to convince him that the author appreciated the greatness of the issues of agricultural chemistry. Unfortunately we know a thousand times as much as we apply. If we are to get the farmers to absorb and to love the new knowledge we must revolutionize rural communication, reorganize the social life of the farmer, remove the terrible isolation of remote settlement and give the conditions that make life a joy. Then science may come to its own in relation to farm life.

Mr. Davies said the paper showed the vital influence of chemistry in agriculture, and there ought to be a better public education on this point. The war had cost Canada $400,000,000, and if one million—that is to say a quarter of one per cent. of the funds devoted to purposes of destruction—were devoted to a constructive policy of scientific agriculture the economic burdens of the country could be borne lightly.

Professor Field, of the University of Toronto, endorsed this and called attention to the remarkable advances of the United States in research work. He recently visited the Bureau of Standards at Washington where three hundred trained men, many of them chemists, were employed. He was struck with the research work done by some private companies. One company had a research laboratory costing $500,000 a year and another company had a laboratory for pure science to which they welcomed science investigators, no charge being made for the use of the laboratory.

Dean Goodwin said the members would be glad to learn that in the matter of releasing chemists from military service he had an intimation that two of the Queen's students would be allowed to return to Canada in time for the next university term.

Mr. J. A. DeCew, of Montreal, spoke of a recent visit to Saskatchewan, where the problem of the so-called "bad lands" seemed to require investigation. The failure there of these patches in times of drought was due to excess of alkali in the soil. The question was whether the sodium sulphate in these lands could be washed down into pits or trenches to lessen its solvent action on the roots of the grain in times of drought.

Dr. Boswell said he was not familiar with the local conditions and the answer to the question would depend on the other factors.

A hearty vote of thanks was passed to Dr. Boswell for his comprehensive paper.

Mr. T. Linsey Crossley, as chairman of the committee on technical education, of the Pulp and Paper Association, reported the text of a resolution passed at the recent convention of that

association in Montreal. The resolution urged upon the government the necessity of following up the findings of the Canadian Commission on technical education of 1910, which called for the creation of a national scheme of scientific training to meet the conditions of this country after the war. The resolution was referred to a committee with a view to action on the lines suggested by Mr. Crossley.

The secretary reported that the memorial to the Dominion Government on the question of military service and the chemists had been approved by the Montreal Section and the Ottawa Section and has now been forwarded to Government through Mr. Wardleworth.

National Clay Products Association

The sixteenth annual convention of the Canadian National Clay Products Association was held at the Prince George Hotel, Toronto, January 29th to 31st. There was a good attendance and an enthusiastic discussion. The meeting was opened by Rev. A. Imrie and presided over by Mr. Thomas Kennedy, the president, Mr. Greaves-Walker, being detained en route. The following executive was elected for the ensuing year:—Past president, A. F. Greaves-Walker, Baltimore, Ind.; president, Thos. Kennedy, Swansea; 1st vice-president, Wm. Burgess, Todmorden; 2nd vice-president, R. H. New, Hamilton; 3rd vice-president, G. A. German, Toronto; secretary-treasurer, Gordon C. Keith, Toronto.

Councillors—Chas. B. Lewis, Toronto; John S. McCannell, Milton; J. Edward Frid, Hamilton; Walter Clark, Corunna; N. T. Gagnon, Montreal; T. H. Graham, Inglewood; Andrew Dods, Mimico; and Chas. A. Millar, Toronto.

Chairman Technical Education Committee—Millard F. Gibson, Toronto. Chairman Entertainment Committee—Chas. A. Millar, Toronto.

Among the interesting papers presented were the following: "Refractory Materials in Canada," by Joseph Keele, B.Sc., chief engineer, Ceramic Department, Mines Branch, Ottawa; "Difficulties in the Manufacture of Clay Products," by Dr. L. L. Plant, Georgetown; "Burning by the Use of Forced Draft and Low Grade Fuel," by W. G. Worcester, who described how lignite and the poorer grades of bituminous coal could be used for this purpose; and "The Relation of the Economic Geologist to the Clay Industry," by N. B. Davis, B.Sc., M.A., Kingston, in which Mr. Davis dwells upon the necessity of the application of scientific principles and technical control to the management of industrial enterprises and shows how the geological engineer, had he received recognition, could have saved many plants in the clay industry from financial loss and even disaster. It would appear from the points brought out by Mr. Davis that the economic geologist working hand in hand with the chemical engineer would form a team which would insure success in locating and developing any clay industrial enterprises.

British Chemical Trade Committee

In Great Britain there is a committee on the chemical trade formed under the auspices of the Ministry of Reconstruction, to deal with problems of the chemical industry now and after the war. This committee, of which Sir Keith Price is chairman, has made a report to the Minister.

The report urges the closest co-operation between the Minister and representatives of the trade, but the difficulty is to name any association that can now fulfil this need. The Association of British Chemical Manufacturers is suggested as the present most representative body, but any other branch of the industry wishing to be brought into touch with the committee can be taken into consultation. It is suggested that a sub-committee or section be appointed to deal with current problems, the chairman of the section to be a scientific man in good standing. The duties of this section would be to study the problems that will arise after the war; to broaden the industry at home and abroad, to collect information and statistics of the chemical trade.

The report which is printed as a parliamentary white paper, concludes:

"In the foregoing report we have confined our recommendations within the narrow limits defined by the terms of reference, which speak only of 'Chemical Trade.' If, however, for that expression were substituted 'the National Chemical Industry,' a much broader purview would be involved, and specific reference would be necessary to existing organizations other than those specifically founded for 'trade' purposes, among which may be mentioned: The Society of Chemical Industry, the Government Laboratory, the Committee of the Privy Council for Scientific and Industrial Research, the Imperial Institute, the National Physical Laboratory, and the Chemical Society."

Business Items

An American firm, the United States Varnish Company, 41 Park Row, New York, has placed on the market an acid proof paint for which very strong claims are made. It is said to be proof against acids and alkalis and their fumes, and also proof against chlorine. Its acid and alkali proof properties are attributed to the fact that it is made of acid proof gums, and contains no oil, asphalt, coal tar or pigment. It is said to dry in the air in half an hour and is permanently flexible and adhesive. It will not dry out, crumble or peel, and is non-deteriorating even when subjected to severe conditions. It is a deep black, and will stand a temperature of 350 degrees Fahr. The company is making it a simple matter to test this product by sending, upon request, a small piece of tin coated with this special paint.

The Canadian Ingersoll-Rand Company, Limited, Montreal, has recently issued Bulletin K-301-A, describing two-stage, power-driven air compressors, of the duplex type, "PLB-2.' This is a 16 pp. 6×9 pamphlet outlining notable features of construction, such as the "Circo" leaf valves, Haight 100% belt wheel joint, bath lubrication system, dust proof frames and casings, etc. The Bulletin also indicates the marked compactness of the design, yet easy accessibility of all parts.

To supply chemical, metallurgical, mining and other industries with tanks for all purposes the National Equipment Company, of which J. Y. Ormsby is president, and manager, have embarked in this line as a specialty. When carrying on the business of pneumatic water systems Mr. Ormsby found difficulty in procuring tanks that were air-tight as well as water-tight and his company decided to provide the equipment for this need under their own supervision. The result is that the National Equipment Company, whose works are at 1 Wabash Avenue, Toronto, have been able to supply tanks and reservoirs for some of the largest machinery dealers in Canada, as well as for some of the largest industrial works. The company build tanks up to a capacity of 10,000 gallons, and at present have, what is perhaps a unique advantage in these times of shortage, an abundant supply of steel plate for all needs in this line.

Canadian Section American Institute Electrical Engineers

Professor A. P. Coleman addressed the Toronto Section of the American Institute of Electrical Engineers last month on a recent trip across the South American continent. The lecture was illustrated by a wonderful series of lantern slides, produced by the speaker's camera. On February 15th, C. R. Dooley, of the Westinghouse Company, Pittsburgh, addressed the Institute, on the subject, "Training Men for Industry."

The business of the Canadian Inspection and Testing Laboratories, Montreal and Toronto, is being voluntarily liquidated. Mr. N. H. Manning, who has been in charge of the Toronto office, is taking over the Toronto equipment and is being joined by Messrs. Marshall and Rogers, consulting chemists. A charter for a new company is being applied for.

The Nitrogen Problem

(Concluded)

Professor Dr. Lemmerman, in his recommendations to the German Government at the outbreak of the war to take immediate steps for the erection of Government nitrogen factories, said:

"We are short 880,000 tons of nitrogen salts, compared with the usual consumption. If one calculates this quantity to its grain equivalent, the resulting crop shortage will amount to 3,300,000 tons of grain."

Available Sources of Fixed Nitrogen

Nitrate of soda: The deposits of nitrate in Chile are rapidly decreasing, and it is estimated that the exhaustion of the rich and more cheaply worked deposits is only a matter of a comparatively few years. Export taxes on shipments of nitrates are the only source of revenue to the Chilean Government. These taxes and high ocean freight rates, as well as increased mining costs, account for the high prices at which nitrate has been selling in recent years.

Sulphate of ammonia: The production of sulphate of ammonia as a by-product of the distillation and coking of coal for its successful existence must have a full and adequate return on every one of the other by-products. The production of ammonia for the year 1912, as published by the American Coal Products Company, and accepted by the Government in its bulletins, was the equivalent of 165,000 tons of sulphate of ammonia. It has not been possible to learn what part of this equivalent production was actually in the form of sulphate of ammonia suitable for use as a fertilizer.

On the basis of the census returns for 1909 it is estimated that only about 40,000 tons of sulphate of ammonia were made as such for agricultural purposes. After all the discussion and the great importance that by-product ammonia has assumed in the public mind, in its relation to agriculture, an investigation has shown that the by-product coke oven is applicable to no greater production percentage of the coke demand than is represented by the maximum iron production, and that only half of this demand is practicable of being economically filled from the by-product ovens. This, then, seems to be the main limitation to the growth of the by-product oven, which produces, for the most part, the ammonia that is acidulated for fertilizer purposes. There seems also to be a natural limitation to the growth of the by-product oven of not more than one-third of the total metallurgical coke production, which would be equivalent to the coking of about 20,000,000 tons of coal per annum. This; under the present methods of operation, would be sufficient to produce the equivalent of only 200,000 tons of sulphate of ammonia per annum, of which only about 75,000 tons would be available for agricultural uses. The other 125,000 tons would find a ready demand at profitable prices in the form of aqua and anhydrous ammonia. Therefore it may well be considered that the actual commercial limit of sulphate of ammonia production from by-product ovens for agriculture will not exceed 100,000 tons per year.

Organic ammoniates: We have now reached the limit of fertilizer ammoniates derived from the animal and vegetable matter, such as bone, meat tankages, seed meals, etc. Practically all of these materials are being utilized to an increasing extent each year for stock-feeding purposes because of their greater value in that direction. The production of these materials is large and important, but far from sufficient to meet the demands of agriculture and quite prohibitive in cost for general fertilizer use.

Atmospheric nitrogen: The fixation of atmospheric nitrogen may be expected to give the world its nitrogen supply at one-half the price that it would otherwise amount to. It is a wonderful providence that perpetual and inexhaustible supplies of nitrogen may be obtained from the atmosphere by the use of hydroelectric power. Hydroelectric nitrogen plants have long been in operation in Norway, Sweden, Germany, Australia, Switzerland, Italy, France, Spain, and Canada, but there are none in the United States. The industry has been in commercial operation for approximately ten years. It has long emerged from the experimental period, and as early as 1913 was represented by an investment of approximately \$60,000,000. The annual value of the product is upward of \$30,000,000.

The total quantity of nitrogen fixed by existing processes prior to the war is divided in the ratio of about two-thirds to cyanamide and one-third to the arc processes. The annual production capacity of the existing plants employing the arc and cyanamide processes was between 90,000 and 100,000 net tons of fixed nitrogen at the beginning of the European war. The German production, by the cyanamide process, according to latest reports, has been raised from 60,000 tons of cyanamide in August, 1914, to 600,000 tons at the present time.

The cyanamide process: The cyanamide process for the fixation of atmospheric nitrogen as operated in Europe and Canada can be established in the United States if a plentiful supply of water power is made available. Of all the processes of obtaining nitrogen compounds none is as cheap or unlimited in the amount that can be produced as the cyanamide process. The greatest heat and the greatest cold obtainable are utilized in making cyanamide. By the intense heat of the electric furnace (6,000° F.) lime and coke are fused together to make calcium carbide. This is powdered and placed in large drumlike ovens and then brought by electricity to a white heat. In the meantime wonderful machines are making liquid air by compressing and cooling over and over again clear, pure air until at 380° below zero the air liquefies. Air is four-fifths nitrogen and one-fifth oxygen. When the liquid air is warmed a little only pure nitrogen gas is given off. This is pumped into the drum-shaped ovens containing the white-hot carbide, by which it is absorbed and by which it is permanently fixed. The product, cyanamide, when cooled, ground, and processed with special machinery, is suitable for use as a fertilizer.

Cyanamide is a bluish-black, odorless, powdered material. It contains from 20 to 22 per cent. atmospheric nitrogen. The factories located at Niagara Falls, Canada, have been increased from an original capacity in 1909 of 12,000 tons to 64,000 tons cyanamide per annum in 1914, and at which rate they are now operating. The product is used by over three hundred fertilizer manufacturers in the United States, and it is estimated that cyanamide is now used as a source of organic nitrogen in about one-quarter of the total ammoniated fertilizer mixtures consumed in the United States.

Ammonium Phosphate

It is quite easy to obtain ammonia gas from cyanamide by treatment with superheated steam. This ammonia can be fixed in phosphoric acid to make a patented chemical fertilizer known as "ammo-phos," which is principally phosphate of ammonia. The phosphoric acid used in the process is obtained from phosphate rock by extraction with sulphuric acid or by electric-furnace treatment. The ammo-phos resulting from the combination of ammonia and phosphoric acid is a dry gray or cream-colored powdered material that looks very much like ordinary acid phosphate. Ammo-phos contains about 12 per cent. ammonia and 48 per cent. available phosphoric acid. The ammonia (nitrogen) content can be increased to 20 per cent. and the phosphoric acid reduced to give any desired ratio of ammonia (nitrogen) to phosphoric acid. Both constituents are almost entirely water soluble. The product is perfectly neutral, pleasant to handle, and will keep indefinitely. Ammo-phos is the result of years of research to develop an ideal or universal fertilizing material from atmospheric nitrogen fixed by the cyanamide process. It can be mixed in any desired quantity with potash salts. A mixture of ammo-phos and potash salts would equal in all respects the so-called and recently exploited "universal fertilizer" with which Germany threatens to revolutionize her agriculture.

Importance of Nitrogen and Phosphoric Acid

One hundred and seventy-seven millions dollars was expended for commercial fertilizers in the United States during the year 1914. Of this amount $78,000,000 was paid for nitrogen and $65,000,000 for phosphoric acid, a total of $134,000,000 for both, or over 80 per cent. of the entire bill. Only $43,000,000 was paid for potash. Germany is smaller than the State of Texas, yet she uses more fertilizer than the entire United States—about $200,000,000. Her crop yields are approximately 80 per cent. greater than the yields of this country. If the United States had available an adequate cheap supply of fertilizer, and used it at the German rate per cultivated acre, and secured thereby the same increase in production credited to the use of fertilizer in Germany, there would be a net gain in crop yields to the United States, over and above the cost of fertilizer, of $1,000,000,000 per year.

Merits of Ammo-Phos

Ammo-phos has been tested on twenty-three different farm crops in all parts of the United States. These tests have demonstrated that it is equal or superior to ordinary fertilizers that furnish the same amount of plant food constituents. The material contains more than 60 per cent. of plant food, and is therefore three to five times as rich in fertilizing value as ordinary fertilizer mixtures, which usually contain only 12 to 20 per cent. plant foods. Hence only one-third to one-fifth as much ammo-phos need be applied in the form of mixed fertilizers.

The highly concentrated form of ammo-phos can be expected to greatly reduce the present-day expense of hauling, freighting, mixing, bagging, handling and applying fertilizers. There are no material limitations to the amount of ammo-phos that can be produced.

Pure ammonium phosphate can be made in large quantities as a by-product of the manufactured ammo-phos. The principal industrial use of pure ammonium phosphate is for fireproofing textiles and other inflammable materials and in the manufacture of baking powders, etc.

Requisites for the Manufacture of Ammo--Phos

1. A plentiful supply of cheap water power.

2. Large quantities of phosphate rock—which can be readily obtained from the deposits in Florida, Tennessee, and Western States.

National and Economic Considerations

Ammo-phos on the unit of plant-food basis, and if made in sufficient quantities, would effect a saving in the cost of the United States fertilizer bill of more than 50 per cent. on the nitrogen and 20 per cent. on the phosphoric acid. If it were made in sufficient quantities to furnish United States farmers all the nitrogen and phosphoric acid necessary to fertilize their cultivated acreage, at the same rate that the Germans fertilize, then our total expenditures for fertilizers would be only $580,000,000 instead of $740,000,000, which would be the cost for the grades now obtainable. Based on the best figures obtainable, this expenditure for fertilizer should raise the total value of all farm crops from $5,487,000,000, census 1910, to $7,130,000,000, leaving a net gain, after deducting the cost of fertilizer, of $1,240,000,000. This great figure of gain is worthy of the most serious consideration in connection with this country's problems on the cost of living, readjustments of land values, conservation, and means of providing adequate national defense.

The plants and equipment for making ammo-phos would be available, in time of war, for furnishing great quantities of nitric acid and sulphuric acid. The various kinds of gunpowder, explosives, and primers used in cartridges, grenades, shrapnel, bombs, torpedoes, and the like require for their production large amounts of both the acids named. In this respect the establishment of one or more ammo-phos factories would be an excellent preparedness measure.

Ammo-phos factories can be advantageously located near the large beds of phosphate rock in the United States, and thus assist in the development of this very important resource.

In times of peace, explosives in the war sense are substantially unknown and without use. In their manufacture, as well as in fertilizer, nitrogen is uniformly required as the chief constituent. The only nitrogen material at present available for use on a large scale is Chilean nitrate of soda. Germany began the war with a store of $30,000,000 worth of Chilean nitrate imported mainly for fertilizer purposes. But even this great store was adequate only for a short period, and realizing the impracticability of protecting the long sea route from Chile, Germany turned her attention to increasing the existing plants and equipment within her borders for the fixation of atmospheric nitrogen and its conversion into explosives. Her present use of explosives is estimated by military experts to be a quantity which at the present contract prices for similar explosives furnished in the United States represents approximately an expenditure of $1,000,000 per day. This represents a daily consumption of about one and one-third million pounds of powder, requiring upward of 500,000 pounds of nitrogen.

It was only by applying to her military necessities the inventions of her scientists that Germany has been able to continue the contest and preserve, as her people believe, her national integrity.

The United States Government now has absolutely no means of amplifying its nitrogen supply except as long as it can keep open and unmolested the sea route from Chile to United States ports.

The statement has been attributed to the Secretary of War that "The United States has a store of explosives sufficient only to enable her to conduct a war from 8 o'clock until half-past 10 of the same morning."

Cheap nitrogen is the basis for making and supplying an abundance of fertilizers and explosives. To obtain it in sufficient quantities is a question of the fixation of atmospheric nitrogen. Therefore, the most pressing of all economic questions, that of increasing the country's crop yields and the greatest problem in conducting a war, find a solution in the most wonderful of all modern discoveries—the fixation of atmospheric nitrogen.

Personal

The Public Health Department of the Ontario Government has lost an able officer in A. V. Delaporte, who had charge of the investigations relating to water and sewage. Capt. Delaporte has joined the overseas forces and is now in England qualifying as an officer in the Royal Engineers. He had been attached to the Hydrological Corps with the rank of Captain and served at the Toronto Exhibition Camp last winter.

Colonel W. R. Lang, of Headquarters Staff, in command of the C.O.T.C., professor of chemistry and director of chemical laboratories, University of Toronto, has left for Halifax to take up staff duties in his new appointment in the Halifax Military District, under General F. L. Lessard. Before leaving Toronto Colonel Lang was tendered an ovation at a luncheon by the Officers' Training Company of the C.O.T.C. and in a brief address Colonel Lang bade the men farewell.

Dr. Frank D. Adams, dean of applied science, McGill University, and Dr. W. H. Ellis, dean of applied science and engineering, Toronto University, have been elected honorary members of the Canadian Society of Civil Engineers, now known as the Engineering Institute of Canada.

J. E. Ray, Canadian Trade Commissioner in Birmingham, England, reports that Professor Jackson has been investigating the composition of certain optical glasses. He has succeeded in defining the composition of the batch of mixtures necessary for the production of several glasses hitherto manufactured exclusively in Jena. In these is included the famous fluor-glass. He has also discovered three completely new glasses,

with properties hitherto unobtainable. Progress has been made in the production of a marketable hard porcelain from purely British material, also in discoveries in respect to high-speed steel, which have proved of great value to the Admiralty.

After fifteen years of service as editor of the "Journal of the American Chemical Society," Dr. W. A. Noyes has retired and is succeeded by Dr. A. B. Lamb.

It is reported from New York that a receiver in bankruptcy has been appointed for the firm of Madero Bros., Inc., chemical dealers of that city.

B. Johnsen, Ph.D., lately with the Forest Laboratories, Montreal, as chemical engineer in pulp and paper, is now research chemist for the Hammermill Paper Company, Erie, Pa.

The following students in chemistry have recently been drafted from the University of Toronto into various industries: C. W. Hancock has gone to the British Acetones, Toronto; C. P. Sale to Hamilton as analyst in steel; H. B. Cody and J. Faill to the Sault Ste. Marie as steel analyst; A. H. Dingman, H. C. Kerman and H. C Soehner to the British Chemical Company, Trenton: B. M. McLean and A. Hambleton expect to enter the service of British Acetones, Toronto.

Industrial News Items

The Page Wire Fence Company of Canada, of Walkerville, will erect a new plant at Three Rivers, Que.

The Canada Steel Goods Company, Limited, of Hamilton, contemplate the erection of a $150,000 factory.

A fire which spread rapidly as the result of an explosion of chemicals damaged one of the buildings of the Montreal abattoirs early last month.

The French Complex Ore Reduction Company is applying for a further government grant of $25,000 towards the operation of the plant at Fairview, B.C.

Permits have been issued to the British Acetones, Limited, Toronto, for the erection of an addition to chemical concentrator, $5,500, and a wash house, $10,000.

The large plant of the Quaker Oats Company, at Peterborough, Ont., being built to replace the one destroyed by fire over a year ago is rapidly nearing completion.

The Canadian Metals and Equipment Company, Limited, of Vancouver, propose to erect a plant and smelter on Granville Island. Mr. G. C. Hyatt is president.

The explosion of an acetylene gas tank is supposed to have been the cause of a fire which did considerable damage to the Scotia Steel plant at Trenton, N.S., on January 28th.

A discovery of bauxite has been reported from Kamloops, B.C., and another from near Vancouver. A discovery of 2% nickel pyrrhotite is reported from Jervis Inlet. Bauxite in quantity would assure an important new industry.

The United States Government is making a start in the manufacture of industrial alcohol. The war department will build at Kingsport, Tenn., a plant to make alcohol for polishing gun stocks, etc., and will erect a plant, to cost over $700,000, at Collinwood, Tenn., at which wood alcohol, acetic acid and acetone will be made.

In addressing the United States Senate in favor of a new treaty with Canada under which additional water could be diverted for power purposes. Senator George F. Thompson, of Niagara, stated that one-half the water now going to waste in the Niagara River would furnish power equal to 40,000,000 tons of coal a year.

Work is started at Niagara Falls, Ont., on the huge tube which is to supply 50,000 more horse-power for the Hydro. The tube which is 13½ feet in diameter is to be run through Queen Victoria Park and will be one of the biggest pipe lines in the world. The work on the Chippawa-Queenston Hydro canal, which will furnish some 300,000 horse power, has been proceeding favorably considering the cold weather.

Under the style of Arthur Surveyor & Co., Arthur Surveyor and R. DeL. French have formed a partnership as consulting engineers, with offices at 274 Beaver Hall Hill, Montreal. Mr. Surveyor is a member of the Advisory Council of Scientific and Industrial Research. Mr. French was till recently a member of the firm of R. S. & W. L. Lea, civil engineers, Montreal.

H. W. Thomson, the new Food Controller, has appointed a committee to deal with canned and evaporated fruits, vegetables, milk and fish. C. S. McGillivray, Chief Inspector of Fruit and Vegetable Canneries of the Department of Agriculture; P. B. Tustin, Chief of the Food and Dairy Division, Health Department, Winnipeg; and Dr. A. McGill, Chief Analyst Inland Revenue Department, have consented to act on this committee.

Officers of the Canadian overseas forces have been instructed to obtain the names of all men who have had three years' university training, together with practical experience in industrial chemistry and metallurgy, or of those men who, although without university training, have had at least five years practical experience in the manufacture of explosives or on kindred industries. This order is issued because the services of technically qualified chemists are urgently needed.

The Alloy Steel Works, Limited, Toronto, successors to the Moffat-Irving Steel Works, Limited, have installed a completely equipped chemical laboratory in their plant on Front Street East. Mr. A. M. Morton, B.A.Sc. (Toronto University) and lately with British Forgings, Limited, is in charge. Mr. Morton has had several years' experience in the iron and steel industry. The company makes electric steel castings from scrap and ore and purposes adding a six-ton electric furnace to their plant equipment at an early date.

The operations of the Consolidated Mining and Smelting Company at Trail, B.C., for the year ending September 30th, show marked growth. The smelter is now refining gold, silver, copper, lead and zinc. The new zinc plant has reached a production of over 60 tons of spelter daily. A concentrating mill to treat low grade zinc ores is being operated. During the year a total of 19,968,797 pounds of pure zinc was produced of a value of $3,000,000. The output of lead was 44,260,988 pounds as compared with 39,974,411 pounds in 1916; 7,404,352 pounds copper were produced in 1917 against 4,446,080 pounds in 1916. A record gross value of $13,020,127 for metals produced was reached, the gross value in 1916 being $7,892,549 and in 1915, $6,898,744.

Encourage the Chemist

For years the manufacturer has handicapped the chemist in English-speaking countries. In the first place they have given him a reputation inferior to the German knight of the test tube and then have refused to give him a chance to come into their factories and build up the reputation that would have been easily won long ago if decent opportunities had been afforded.

The German chemist has made a great reputation and a great record. Why? Is it because he is a better man than the scientist of other countries? Most decidedly not! It is principally and primarily because, given the proper training he is equipped for work in the field of research or of work management. And being so equipped he is given every opportunity and encouragement to make good. He does make good, too, at least collectively. The successful German chemical industries are proof of that, and the ability to undersell almost any other producer is a constant remainder that works control under a properly trained scientific man is a paying proposition. Yet many a factory in this country is operating without a chemist because of a short-sighted lack of knowledge or of appreciation of what the chemist can contribute, putting the concern in the

position of a ball team playing without a shortstop or an eleven without a quarterback.

Recent accomplishments of the chemist in all the allied countries has shown conclusively that the German chemist is no more of a superman than is the Teuton in any other role. Looking at the situation in our own country we see wonders performed at short notice and problems solved almost over night that had never presented themselves before. Many branches of chemical endeavor have developed into successful business enterprises as a result of the imperative need for the manufacture at home of some essential material. Notable steps have been made in the matter of munitions, but no less important in the long run is the work that has been done and that will be done in the fields of fertilizers, metallurgy and dye stuffs.

In other lines, where the work of the chemist is not quite so obvious, there is room for very considerably better appreciation of the chemist by the business man. It is a serious reflection on the intelligence of the pulp and paper industry that there are so many mills operated without the semblance of chemical advice, to say nothing of chemical control. Perhaps a little reflection on the difficulty overcome in bringing an engineer within range of the sacred smell of the sulphur burner or size tub will encourage us to hope for the awakening that will put at least one chemist or chemical engineer in every pulp and paper mill. If any mill is not big enough to employ its own chemist it can either co-operate with another in arranging for a joint laboratory or possibly have sense enough to take its problems to a competent consulting chemical engineer.—Pulp and Paper Magazine of Canada.

New Process of Potash from Feldspar

E. A Ashcroft contributes to the Institution of Mining and Metallurgy an account of his experiments in producing potash from feldspar. He has worked out an industrial process and gives cost figures. In the process, orthoclase or microcline feldspar is dry crushed to 100 mesh (I.MM.) in an iron mill and mixed with its own weight of pure dry common salt and then heated to 900-1000 deg. C. for two hours out of contact with air or moisture, or furnace gases carrying such air or moisture.

The sodium base of the salt displaces the potassium base of the feldspar strictly according to the equation:

$$2NaCl + K_2OAl_2O_3\ (SiO_2)_6 = Na_2OAl_2O_3.\ (SiO_2)_6 + 1KCl.$$

If the temperature has not exceeded 1000 deg. C., and if moisture and air have been carefully excluded, the author states that the product will be found to consist of finely divided insoluble sodium feldspar (albite) and a mixture of quite neutral and freely soluble sodium and potassium chlorides. These chlorides may be readily lixiviated in water and are easily separated from each other by fractional crystallization.

The extraction of potash obtainable by this means from a sample of feldspar carrying upwards of 10 per cent. K_2O will be in the neighborhood of 85 per cent. under the conditions above stated. There is no loss by volatilization, and the weights of residue and salt will be found to correspond with the equation.

The experiment can be carried out in a large porcelain crucible (covered), or equally well in a sealed iron or nickel receptacle. Metals are not attacked so long as air and moisture are absent. These containers may be heated in an ordinary assay muffle for the experiment. If metal containers are used, it will be found that only on the outside of the vessel is there any attack, and this is due to air in the muffle. If air and moisture are excluded from the muffle, and a reducing or inert gas substituted, the containers will be very durable.

The author has independently discovered and studied this reaction, but he gives credit of priority for the discovery of the displacement of potash by soda obtained from salt to E. Bassett, who in 1913 patented in the United States and Canada a process based on the same reaction. The author has found that Bassett overlooked the necessity of excluding air and moisture. The author recommends the following as an emergency outfit: A standard bench of large "D"-shaped gas retorts (having 8 retorts to the panel and 10 panels, each panel having its own producer), and all the retorts inverted and provided with new metal end pieces of simple design. The whole furnace outfit is complete for no less than 50 tons potassium muriate of 80 per cent. quality per day. That is as much potash as can be recovered from all the 300 blast furnaces in England put together, and assuming all that source of potash to be made available by means of expensive equipments of fume collectors and precipitators.

The author estimates that in normal times the 80 per cent. salt will not cost 7l. per ton and not more than 15l. to 20l. even under war conditions. He says that any potash process with feldspar as raw material, if it is to be successful on an extensive scale, must stand or fall by a single product.

The whole problem then changes its aspect from a hopelessly complicated to a very simple economic problem, easily comparable with any simple mining venture.

The desirata for such an undertaking may be stated thus: (1) Raw material in extensive deposits which can be quarried cheaply. (2) Reasonably high and uniform potash content of feldspar. (3) Water-borne freights for supplies to and from quarries. (4) A simple and cheap process with reduction works on the quarry sites and not consuming acids or any other expensive materials.

All these desiderata are realized in the extensive deposits in Sutherlandshire, and, no doubt, they can be realized quite as favorably in many other parts of the world, in selected localities, if the same simple aims are kept in view, and the principles and process described are applied.

In New Zealand, in Australia, in Canada, and in parts of the United States, in Portugal, in Italy, and in other places there are favorable deposits of pegmatite feldspars, which lead him to anticipate that this source of potash supply may yet fill a large part of the world's requirements.

All consideration of by-products in such schemes should be a secondary thought, and should not form an essential part of the scheme. The author does not doubt that in some cases the treated feldspar may find useful applications and so add to the returns, but it must not be depended on for the results of any such enterprises.

Mr. Dougall, chief chemist of the Canada Sugar Refinery Company, Limited, Montreal, giving evidence in the case of the appeal against the exemption of A. Martin, assistant chemist, stated that it would take fourteen or fifteen years for a graduate chemist to learn the process of sugar refining as used at their works. The presiding judge, in reserving decision, said that he could not understand why, if such were the case, Martin was not receiving a considerably higher salary than $20.00 a week.

On February 5th fire causing a loss of $175,000 broke out in the plant of the Toronto Laundry Machine Company, where shells were being manufactured. The fire was caused by the condensation of fumes from the boiling rosin tank due to the extreme cold at the time, the condensed fumes reaching and becoming ignited by the flame heating the tank.

By an explosion in one of the nitrators in the works of the Canadian Explosives Company at Beloeil, Que., on February 1st two men were severely injured. The work of the rest of the plant was not interrupted by the accident.

Manitoba may soon take rank among the large copper producing provinces. From Schist Lake, in North Manitoba, there was shipped last year 3,500 tons of ore, estimated to contain 1,500,000 pounds of refined copper, and it is expected the shipments this year will exceed 10,000 tons.

Metallurgy as a Motive and Instrument of War

In an article in Queen's Quarterly, urging the development of Canadian mineral resources, Professor S. F. Kirkpatrick places in an interesting light the part which metallurgy has played in the preparations for, and the economic motives of, the Great War.

The metals, he says, have played an important part in the development of civilization from the earliest historic times, down to the present. They have been a factor in determining the fortunes of war. The bronze armed warrior drove out the man of the stone axe and the iron equipped soldier in his turn subdued the bronze armed races. History tends to show that the claim "the strength of a nation can be judged by the success with which it practices the metallurgical arts" has a true foundation. To-day as never before the rulers of the nations recognize the part that the metals play in determining the fate of nations.

Great Britain was the greatest coal, iron, and general metal manufacturer of the 19th century and as such was secure in her premier position among the nations. Germany, however, early recognized the need of iron and steel for the furtherance of her scheme of conquest and as early as 1870 exacted from France as penalty of defeat what was then supposed to be practically all the iron fields of the Minette district of Alsace-Lorraine, the most important iron ore reserve in Europe.

With this resource and her own coal fields around Essen, Germany then proceeded to foster her steel industry, increasing her steel production in the quarter of a century immediately preceding the war almost twelve times from 1,600,000 metric tons in 1888 to 19,300,000 metric tons in 1913. During this time Great Britain's output increased only two and one-half times from 3,000,000 metric tons in 1888 to 7,500,000 metric tons in 1913. That is, at the beginning of the quarter century preceding the war, Great Britain produced twice as much steel as Germany, while at the end of that period Germany's productioon was two and one-half times that of Great Britain. Fortunately the production of the United States increased almost thirteen times during this period from 2,400,000 metric tons to 31,000,000 metric tons.

How Germany Prepared

It is interesting to note that preparation for hostilities was probably one of the chief causes of the activity of the German steel industry during the years immediately preceding the war. For instance, part of the energy of the iron manufacturer was directed to the building of the strategic railways on the East and West fronts that in many cases were required for no other purpose than that of the rapid mobilization of troops. The German steel industry also led in the production of war munitions, such as the manufacture of cannon. The Belgian forts were equipped with Krupp guns that could be blown to pieces by larger guns manufactured in the same works.

It might also be said that Germany's success in the manufacture of steel was an important factor in encouraging her to defy the other powers of Europe.

When war started the main strategy of Germany was to cripple France in her coal and iron resources and by the advance through Belgium into the northern part of France Germany came into temporary possession of almost all the iron and coal of continental Europe. This would have been disastrous to French hopes if it had not been that Great Britain was ready, pressed though she was, to come to her assistance. We are only beginning to understand now how serious the situation was in the fall of 1914.

Germany was not so well situated in regard to some of the non-ferric metals, especially copper, as she was manufacturing only three per cent. of the world's copper before the war, while consuming thirty per cent. But even in this industry we can see her appreciation of the metals, as some of the copper mines were said to be operating at a loss before the war and were being kept open only by government aid. This was then said to be a splendid example of the paternalty of the German government that wished to keep this industry on its feet so as not to have to throw so many miners and metallurgists out of employment. Now we are able to appreciate that there may have been other reasons for Germany's encouragement of this industry.

Machines Replacing Manual Labor

Since the war started, needless to say, all those closely in touch with military operations recognize the value of the metals as they are required for all parts of the huge army and navy machines. Never before has the need of replacing manual labor with machinery been so keenly felt in the industries.

Even an industry, such as agriculture, often rather antagonistic to the industrial life of the country, is becoming more than ever dependent upon the metals and their successful manufacture into farm equipment. As an example, when Great Britain was first confronted by the intensive submarine war the authorities recognized the need of developing her neglected agricultural resources, but they had no men to throw on the land. It was to the machine manufacturer that they appealed and thousands of farm tractors were rushed over from the workshops of America to take the place of the army of men that would otherwise have been required.

The great need of metals is to-day emphasized by the recognized necessity of steel for ship building. The iron manufacturing resources of the United States, great though they are and stimulated by high prices, are being taxed to the utmost. Government orders take first place and the civilian consumer has often to wait. The tendency is to curtail all uses of metal that are not of immediate national importance.

This growing importance of the metals is not only a war effect, for the annual production of iron and steel in the United States has regularly doubled every ten years for the last century, and the end is not yet. Only part of this increased production is due to the increase of the population of that country as the production of iron in the world has increased about fifty per cent. for each decade for the last century.

This increase is followed by the other metals, copper having increased about six-fold in forty years and the latest addition to the family of common metals, namely, aluminum, showed a tenfold increase in the first decade of its use and a tenfold increase during the second decade. It is too early to say what the increase will be during the third, but it will be a very large one.

The Wonders of Alloys

Not only is there a steady increase in the production and consumption of metals but in the variety of alloys or mixtures of metals employed in the industries. Every part of the modern complicated machines of industries, of railroad equipment, army equipment, naval force or flying machines, is studied in order to adapt to each the metal or alloy best fitted to give the greatest service.

This entails a knowledge of metallurgy undreamed of fifty years ago. Now we use iron alloyed with various proportions of one or several of the following elements: Carbon, silicon, manganese, copper, chromium, tungsten, molybdenum, nickel, cobalt, uranium, titanium, vanadium, zirconium, aluminum.

Many of these elements are so important in conferring valuable properties on steel that it has been suggested for each in its turn that a nation cut off from its use could not wage a modern war. This claim has been made in technical and popular literature for nickel and it is only a short time ago that the Ontario people and press were much exercised over the chance that some of the nickel of Canada was finding its way to Germany. Chromium is as essential as nickel in manufacturing armour plates and projectiles.

A strong claim has been made for the vital importance of tungsten. This metal is used in the production of high speed steels and it has been claimed that if this metal could not be obtained the ability of the workshop to produce shells and other war materials would be reduced to a fraction of their present

capacity due to the fact that the ordinary carbon steel cuts so slowly. Manganese is another metal almost essential to the manufacture of steel, and America is feeling a shortage of this metal at the present time.

Metallurgy the New Science

The metallurgy of to-day is becoming a well-developed science, while only fifty years ago it could be considered an art. The properties of metals are determined by the chemist and metallographist with the assistance of physical testing laboratories rather than, as formerly, by the artisan. It is therefore to the trained chemist and metallurgist that we look for development in the production and use of the metals. Research of an industrial and scientific nature is becoming a more important factor.

This work has a bearing on the problem of the shortage of labor. In connection with the production of the metals themselves the tendency is to develop processes for the treatment of ores that will require few men to operate them. We now have large mills crushing and concentrating ten to twenty thousand tons of ore per day, operated by a mere handful of men.

Research also tends towards the elimination of waste. Twenty years ago most of the concentrating and metallurgical plants would have thought they were doing good work if they reovered 70% of the metals in an ore, now 90 and 95% would be expected and obtained. There has also been a development in the method of treating refractory ores containing a mixture of several metals. A few years ago the smelter would have been content to treat the ore for the recovery of one or two of the metals and to let the others go to waste. The modern metallurgist is not satisfied unless he is extracting and marketing all the metals in the ores. Much has been done in this line, but there is still much to do, though each year as it passes sees important gains made.

The war has only intensified the need for these economies and emphasized the need for all the metals we can produce. It also shows the necessity of a country adapting itself to its own resources. This is forcing a greater development in the science and industry of metallurgy than that experienced before the war.

On account of the closing of certain trade routes and the shortage of shipping facilities, America is thrown largely on her own resources. No longer can she depend on the sulphur from the pyrites of Spain or on the manganese from Russia and India, nor altogether on the chromium of New Caledonia or Africa, or the tungsten of India. The metallurgists of America can and are replacing these ores by intensive search into the mineral resources of the country and by developing deposits formerly considered unworkable. New metals are also being developed and new alloys manufactured.

Develop Canadian Minerals

What is Canada's part in this work? We who are sending 500,000 men to France are one of the principal metal producing nations of the world and have a responsibility in regard to this development in metallurgy and the adapting of our metal resources to war requirements.

It is only within the last fifteen or twenty years that Canada has been actively developing her mineral resources and manufacturing metals, but she already takes an important place in the production of iron and steel, copper, lead, aluminum, and is the fourth country in order of gold production. This country also produces one-eighth of the world's silver, one-quarter of all the arsenic consumed on this continent, and has the leading place in the production of asbestos, nickel, and cobalt. Only within the last two years under stress of war conditions metallurgical researches have added metallic zinc and metallic magnesium to the list of her products.

The main object at the present time must be the intensive production of those metals of prime importance for war purposes, but almost all of the metals mentioned come under this head. Steel, formerly so largely used for structural purposes, is in greater demand for war munitions and ships, copper for brasses, lead for munitions rather than paint, aluminum for army equipment and flying machines, and silver, generally considered as a luxury, is in greater demand than ever for the manufacture of currency. Canada supplies the arsenic for the insecticide requirements of over 25,000,000 people. Nickel is primarily a war metal, and cobalt, although used before the war practically altogether in the ceramic industry, is now largely consumed as an ingredient of high speed steel and in the manufacture of the new tool metal, stellite, used largely for the turning of shells.

The mining and metal production of Canada will be an important factor in post-war conditions, as an abundance of metals will be required during the building up stage, and with the influx of labor Canada should be able to supply these from her developed and undeveloped resources.

Rosin Soap

Mr. J. A. DeCew, of Process Engineers, Limited, Montreal, writing in the Pulp and Paper Magazine, on the manufacture of rosin size, deals with the saponification or "cooking" of rosin soaps from the standpoint of temperature and pressure. Much difference of opinion has prevailed as to the best methods to be used and the matter has largely been left to individual opinion. Recent investigations by organic chemists, however, throw some light on the subject. It appears that the early methods of making rosin soap were largely adapted from the standard methods of soap making, an excess of alkali being used to ensure complete saponification this entailing the long salting out process to remove the excess alkali. This method is still in use in many mills under the illusion that it bleaches the product. Investigations have shown that an incompletely saponified rosin soap is more satisfactory for paper sizing and that high temperatures or pressures or long continued heating seriously injures the product due to the abietic acid of the rosin becoming partially decomposed. The free rosin size retains to a degree the elasticity of the fresh gum rosin and aids in resisting the drying and crushing action of the paper machine. It is stated that the best size is made in less than four hours cooking time and under atmospheric pressure and should be made fresh and in small batches.

The class of rosin made from dead timber is very unsatisfactory for the manufacture of size probably due to its being an altered product.

The sensational articles, published so widely in the daily papers recently, relating to a supposed "Capture of German Dye Secrets," by a group of men in the British textile trade have been relegated to the land of Fairy Tales by F. M. Rowe, M.Sc., of the Manchester School of Technology. Mr. Rowe was mentioned as the agent of the textile men and the exploits credited to him would make a first-class moving picture thriller. Mr. Rowe, in an interview with the Drapers Record, repudiates the story entirely and points out that the difficulties in the dye industry lie more in the plant equipment than in the technical end.

Forest Products Laboratories

The Canada Lumberman and Woodworker deals editorially with the work of the Forest Products Laboratories at Montreal, an institution conducted by the Dominion Government with the co-operation of McGill University and enters a plea for more adequate assistance from the Government to enable the Laboratories to overcome the handicap of greatly inadequate equipment and restraint in their field of work under which they have labored for two years past.

In spite of this handicap the record of the Laboratories for the past year has been a creditable one and several knotty problems especially in the pulp and paper industry have been solved and the very reasonable view is expressed that if reasonably well equipped and staffed the Laboratories could demonstrate to the lumber industry also that they can solve a number of the difficult and long-standing problems of lumber manufacturers.

Coal Tar—Its History and Production*

By Clayton W. Reynolds

It was towards the latter end of the seventeenth century, that coal tar was discovered through observations by a German chemist, Becker. In 1738 and 1739 an English chemist, Clayton discovered gases on distilling coal. The first gas works was erected in England in 1798. Although the distillation of coal was first discovered in Germany, it was not until 1826 that Germany erected her first works.

The Germans in 1815 discovered that by boiling tar in a closed vessel or still, that a naphtha oil was given off, but very little notice was taken of it at that time.

Coal war was first used for burning under the retorts and considered a nuisance. The first commercial use given for coal tar was in the manufacture of roofing felt, being also a German discovery. Heating in open vessels, to saturate the felt, it was found that oils were given off in vapor, hence the origin of oils from coal tar Previous to this, felt was first saturated with wood tar in Sweden. It was in England that the distillation of coal tar started on a large scale by Bethell in 1838, the product then called creosote, used for preserving timber. In 1847 the Germans discovered the lighter oils and naphthas, but had to return to England for the discovery of benzol by Mansfield and aniline by Perkin, derived from benzol.

Production of the Coal Tar at the Gas Works

Coal tars are divided into three classes known as gas house tar, coke oven tar and blast furnace tar, of which the first two are the most important There are other tars known as petroleum tars classed as water gas tar and oil tar,—also pine tar.

Gas house tar is a by-product obtained in manufacture of coal gas. Bituminous coal is placed in retorts 8 ft. long, 15 inches high, 18 inches wide. These retorts are heated after all air vents are closed, the volatile products given off are condensed and collected under water. The products consist of ammonia water and tar combined, and gas, the amomonia water and tar run off to a separating well and the gas to the holder, after purifying. This coal tar has a Sp.Gr. of 1.150 to 1.250 and free carbon 20 to 30%. The character of the coal will have considerable effect on the tar as also the temperature at which the retorts are worked, they vary from 850 to 970'F. known as low temperature, 1100 to 1540'F. known as high temperature. The yield of tar per ton of coal will vary from 8 gallons when a high temperature is used, and 16 gallons when low. The amount of gas increases with the temperature, while the quantity of gas increases, the quality diminishes, the gases having to be enriched with addition of oil products.

The higher temperature will also increase the quantity of naphthalene and anthracene in the tar and lower the phenols and creosols.

Coke Oven Tar

There are two types of coke ovens in use at the present time, in one of which no attempt is made to recover the volatile products. This is known as the Bee Hive type principally used in the United States and in Scotland. This is the oldest form of oven, made of bricks, and has the form of a bee hive. The coal is placed in the oven or kiln and burned from the bottom, the volatile products escaping at the top to waste. Coke ovens in which the by-products are saved are now being used to a large extent, the coke from this process being chiefly used for metallurgical purposes.

There are several kinds of ovens, Coppee, Otto Hoffman, Simon Carves and Semit Solvey. The coal is charged into long narrow chambers of retorts from 4 to 6 tons capacity, the volatile products are collected in similar manner to gas house methods.

The object of the manufacture is to obtain all the coke possible, and the oven is fired at a low temperature not to exceed 1000'F. This results in an increase in yield of tar over the gas house method, also of a lighter quality Sp.Gr. 1100 to 1170, free carbon 6 to 10% also lower in naphthalene and anthracene and high in phenols and cresols. The coal gas is used for heating up the retorts, previously having passed through a recovery process to extract the benzol and toluol which are the main factors of illuminating and which can be dispensed with for heating.

Most of the benzol and toluol is manufactured in this way. The gases after coming from the ovens are purified, and then pass through a washing process, composed of a high boiling creosote or petroleum oil the benzol and toluol are taken up or absorbed by the oil, which is recovered by distillation. They are now in the form of crude benzol and toluol and require further distillation.

Water Gas Tar

The method of manufacture of water gas is based on decomposition of steam by incandescent coke or anthracite. The gases are enriched for illuminating, with a petroleum oil heated to a gaseous state and mixed with the water gas. The heavier vapors from the oil later condense upon cooling and form the water gas tar, which in reality is an oil tar. The quality of oil tar varies, as in the case of coal tar, according to the temperature at which it is worked. Water gas tar is free from free carbon and has a Sp.Gr. of 1.000 to 1.100.

It is sometimes used as a dust preventative for roads, but shortly disappears after application. It is also mixed with coal tar for road composition. As compared with coal tar it is much lighter, is free from ammonia, but has similar distillates, except being practically free from naphthalene anthracene and phenols.

Oil Gas Tar

This is manufactured in a similar manner as water gas tar. A petroleum or shale oil is first volatilized and introduced into a red hot retort, part of the oil escapes decomposition and is condensed, forming oil gas tar.

Oil gas is chiefly used for lighting wayside stations, being shipped in railroad receivers or tanks. It has been used extensively in England, France and Germany for lighting railroad carriages. Oil tar contains small quantities of benzol and toluol and a large amount of naphthas, about 4% of naphthalene and little or no anthracene and no phenols, the residue pitch makes a very good base for a fine black enamel or varnish.

Distillation of Coal Tar

The gas house tar and coke oven tars are usually mixed together in various proportions according to the quality of the oils and pitch required. This tar mixture, before distillation is usually dehydrated by a continuous steam or fire distillation, which removes the water and some of the light oils from the tar The tar is then ready for the stills. The stills are chiefly constructed of wrought iron upright cylinder type, dome shape top and concave bottom. These are chiefly used in England and Germany and hold from 10 to 25 tons of tar per charge. In America and in some places in Canada, the horizontal steel stills are used, holding from 5 to 20 tons. These stills take longer to work than the cylinder stills, under similar conditions, owing to not being fired with a direct flame. They have arched brick-work between the flame and the still-bottom, to counteract this, agitation is used, while the cylinder still has a direct flame play and without agitation. A tar still operation takes various lengths of time according to the size of the still and various methods of working. Using a hot still and dehydrated tar an average still would take ten to twelve hours to work.

To follow the genealogical tree, we first have the coal from which we produce the ammonical liquor, coal tar and gas. From the liquor we get ammonia, ammonium sulphate and other ammonia products. On distilling the coal tar, we get the following fractions, ammonical liquor, crude naphtha, light oil, crude carbolic oil, or middle oil as it is sometimes called, then creosote oil and last, anthracene oil, the residue as pitch. These are the first crude products.

* From a paper read before the Society of Chemical Industry, Montreal.

Various melting point pitches are formed by the distilling off of various percentages of oils, pitches such as paving, roofing and hard pitch, also road compositions. The change from one product to another is got by fixing a point suitable to the manufacturer according to the quality of the oils he requires In working for a low melting point pitch up to 150'F. no anthracene is distilled off and remains in the pitch. The first three products, crude naphtha, light oil and crude carbolic oil are the fractions which require the most working up and contain the benzol, toluol, naphthas, phenols, pyridine bases and napthalene. These products are worked up in various ways, some firms extract the phenols and pyridine before re-distilling, while others distill them before extracting, the latter method gives cleaner washings.

These crude products from the first distillation of coal tar, are subjected to a further distillation in similar stills to the tar still, but they are fitted with fractionating columns of various sizes and heights. Some as high as 30 to 40 feet. These colums are fitted with perforated baffle plates every four feet or so in the column, which split up or analyse the high boiling vapors from the low ones, so that in this way you get the crude products of benzol, toluol, naphthas and carbolic oil. These products are treated for phenols and pyridine and then undergo another distillation. After this washing treatment the crude benzol, toluol and naphthas are redistilled in steam stills instead of fire which hold from 5,000 to 20,000 gallons.

This is where the refining process comes in. The washed crude benzol is charged into the still and distilled up a huge column similar to the crude product stills only more complicated form which split up the vapors until they reach the top, where they are analyzed or partly condensed through a water condenser or analyser, before passing as a finished product to the final condenser.

From the crude benzol we get benzol 90% and 50%, that is benzol testing 90 and 50% at 100'C., a little toluol 90 and 50% 120'C., also a little xylene. As also from crude toluol with a distillate of benzol 50%, toluol 90% 120'C. and 50% and xylene 90%.

The products known as pure benzol, toluol and xylene are produced from the benzol 90% toluol 90% and xylene 90% after being treated with strong sulphuric acid, to extract higher hydrocarbons which would otherwise discolor the products when in contact with the light for any length of time, these washed products of benzol, toluol and xylene are then rectified again in a still like that mentioned, and the pure products collected. The distillation of the naphtha after treatment for phenols and pyridine is distilled in similar stills as crude benzol and toluol, fractions collected of solvent naphtha and heavy naphtha. The crude carbolic oil fraction from the tar still is redistilled in fire stills similar to crude naphtha and light oil, a small fraction of heavy naphtha is collected, then continued for carbolic oil until a sample from the condenser shows on carbolic acid or pyridine. This carbolic oil fraction is very rich in phenols and naphthalene, After treatment these are allowed to cool down to about 70 or 80'F., and are by that time in a pasty or muddy mass and then passed to a centrifugal machine which extracts the naphthalene in a crude form. The liquid oil is run off from the machine into a tank, and is then known as liquid creosote.

The crude naphthalene is sold on the market in this state as well as refined. After treating with sulphuric acid and water, it is re-distilled in stills similar to a tar still and again passed through centrifugal machines leaving it in a pure white state.

Carbolic Acid and Cresylic Acid

All of the products from crude benzol to carbolic oil more or less contain carbolic acid and cresylic acid known as tar acids, and in washing these oils before distilling, are treated with a 10 to 20% sodium hydroxide solution. They are washed by agitating with air, in some cases they are washed three or four times according to the percentage of tar acids in the oil. Each wash gets weaker in percentage of carbolic acid, so that in some cases the wash will contain no carbolic and only cresylic acid. The alkaline wash known as carbolate of soda, and in some cases cresylate of soda, is now neutralized with sulphuric acid or CO2, which forms the tar acids and the sulphate of soda, the tar acids being the upper layer. Should on distilling a small sample of these tar acids and would crystallize above 25'F. this product would be considered suitable for crude carbolic acid.

As previously mentioned, each wash will be weaker as it proceeds, according to the quantity of the alkali used. A small quantity would give a high crystalizing carbolic. The crystalrlizing points of the washes vary from 25' to 90'F. so that all taacids crystallizing below 25' F. is known as cresylicacid.

Pyridine

Pyridine is obtained by washing the crude benzol, toluol, naphthas and carbolic oil with sulphuric acid about 10% solution. The pyridine sulphuric acid is then neutralized with caustic soda about 40Twd forming crude pyridine and sulphate of soda. The crude pyridine is then dehydrated with 80Twd caustic soda, after which is ready for rectification. The stills used are similar to crude oil stills, the first fraction contains watery pyridine and ammonia, the second fraction the rectified pyridine, testlng 90% to 140'C., the third fraction is heavy pyridine or quiniline.

Crude Creosote Oil

straight from the stills is chiefly used in its crude state for preserving timber and is also made up into different grades by extraction of the creosote salts and then mixed with liquid anthracene oil. The extraction of the salts is done in like manner to the extraction of naphthalene from carbolic oil. These oils are mixed together in various proportions according to the specification required. The creosote salts are a low crystalizing naphthelene and are used in England for patent fuel and fire lighters.

Anthracene Oil Fraction

Anthracene oil known as green oil or green grease consists of the higher boiling portions of coal tar, its boiling point 280 to to 400'F. sp. gr. about 1,100; its color is greenish yellow when straight from the still, but turns brown in contact with the light and air.

The working up of anthracene oil consists of separating the solid from the liquid portion by cooling and pressing. The liquid oil is sold as liquid heavy creosote and sometimes mixed with the light creosote. The solid anthracene is sold as crude anthracene and is also refined by washing. After the crude anthracene oil has settled, the pasty mass is filtered through a filter press. The collected anthracene is put through a centrifugal machine for further draining which when complete looks similar to napthalene except it has a bright green color.

Pitch

Pitch is the residue from the distillation of coal tar and varies in melting point according to specification. They are sold as follows: Soft pitch, or paving pitch, roofing pitch, medium soft pitch and hard pitch all contain free carbon from 15 to 35%; sp.gr. 1.250 to 1.350.

Road Building Materials from Coal Tar

This product was founded in France. The crude tar then being used, as time went on improvements were made and prepared tars were used by dehydrating the crude tar and also in some cases distilling off some of the light oils and creosote, using the residue as the composition.

These are made in different grades to suit different roads and sold under various names. In England we have Tar mac, Tar co., Pitch mac. In the States and Canada we have the well known material called Tarvia. Tar-macadam and asphalt macadam have been fighting each other since they were known, but experiences and wear and tear are the only means to determine in favor.

Chemical and Metal Markets

The Quotations below represent average prices for the quantities indicated. Larger quantities may be obtained at lower figures.

TORONTO, February 25, 1918.

The market in chemicals is in rather a chaotic state at present. As a representative of one large manufacturing and wholesale house very aptly put it, all one can hope to do is to come within gunshot of the prices on many chemicals. An embargo has been placed upon shipments into this country from the United States of carbolic acid, potash salts and ammonia salts, and it is practically impossible to get any of these over. There are strong rumors of an embargo to be placed on shipments of aspirin, phenacetin, potassium permanganate and other pharmaceuticals. These rumors have not, however, received official confirmation as yet but should they prove to be correct the prices on these chemicals will probably show an advance as certain of the raw materials necessary for their manufacture in this country are short and hard to get. Chemical values in the United States have shown a gradual readjustment as a result of the fuel conservation order and the freight embargoes. The uncertainty of deliveries has caused a particular demand for spot lots. The movement in caustic soda has been very small. Soda ash in barrels has a steady demand and waiting market. Of the acids the supply of hydrochloric and nitric continues small while the available supply of sulphuric is on the increase owing to accumulations at acid works due to transportation difficulties.

The metal market is fairly steady. The American Government price for copper remains the same at 23½ cents for producers with a 5% advance to 24.67½ cents for jobbers on sales of less than car-load lots. The transportation difficulties have hindered production considerably. Lead is firm. Spelter is steady in Canada, but the market in the United States is somewhat irregular. Tin shows a further advance to 86 to 87 cents, the supplies of this metal in the United States are very small owing to the very small shipments being received from the Straits and the market is very unsteady. Since the Canadian embargo on molybdenite has been raised the shipments to the United States have been large with sales at $2.15 to $2.20 per pound for 85% material.

The price of aluminium in Canada shows an increase of 2 cents over last month's quotations, the price now being 40 cents. Production of this metal in the United States this year is expected to exceed that of 1917 by 35%.

The iron and steel market is very quiet at the present time. It appears that the iron and steel industry in the United States was scarcely affected by the fuel conservation order. Transportation troubles present the big problem and although not improved still it is conceded that but for the order they would have become still worse.

Acetanilid, C.P.	Lb.	1 10—1.20
Acetic acid, commercial, crude, 28%, in bbls.	Lb.	.7⅞—.8½
" " 80 per cent. pure	Lb.	.29—.33
Acetone	Lb.	.50— 55
Alcohol. grain, bbl	Gal.	7.50
Alcohol, methylated, .bbl	Gal.	1.60
Alcohol, wood, 95 per cent., refined	Gal.	1.55
Alum, ammonia lump	100 Lbs.	$5.50—6.00
Aluminium Sulphate, high grade, bags	100 Lbs.	3.00
Ammonia, Aqua .880	Lb.	.11
Ammonium Carbonate	Lb.	.14
Aspirin (acetyl salicylic acid)	Lb.	4.00
Benzoic Acid	Lb.	6.00—7.00
Bleaching Powder, 35% drums	100 Lbs.	3.50
Borax, crystals	Lb.	.09½—.10
Boric Acid, powdered	Lb.	.17
Calcium Chloride, fused, in drums	Lb.	.2½
Carbolic Acid, white crystals	Lb.	.90—.100
Carbon Bisulphide	Lb.	.10—.15
Caustic Soda, ground, Bbl	Lb.	.09—.10
China Clay, imported	per ton	$25—$30
Chloroform, com	Lb.	.75—.90
Citric Acid, domestic, crystals	Lb.	.85—.90
Cobalt Oxide, black	Lb.	1.50—1.75
Copper Sulphate (Blue Vitriol)	Lb.	.11—.12
Fuller's Earth, powdered	100 Lbs	6.00
Glycerine, 56 lb. tin	Lb.	80
Hydrochloric Acid, carboys, 18°	Lb.	.03¼—.03¾
Lead Acetate, white crystals	Lb.	.20
Lead Nitrate	Lb.	.18—.20
Magnesium Carbonate, B.P., bbl	Lb.	.14—.15
Nitric Acid, 36° carboys	100 Lbs.	9¼—9¾
Oxalic Acid	Lb.	.55
Phosphoric Acid, S.G. 1750	Lb.	.75
Potassium Bichromate	Lb.	.65—.70
Potassium Bromide	Lb.	2.00—2.25
Potassium Carbonate 90 to 95%	Lb.	.85
Potassium Chlorate, crystals, Kegs	Lb.	.80—.85
Potassium Nitrate......, Kegs		(Nominal)
Potassium Permanganate, bulk	Lb.	4.00
Salicylic Acid	Lb.	1.25—1.50
Silver Nitrate	Oz.	.80—.85
Soda Ash, bags	Lb.	.04
Sodium Acetate	Lb.	.15—.20
Sodium Bicarbonate, 100% pure	100 Lbs.	3.75—4.00
Sodium Bichromate, bbls,	Lb.	.23
Sodium Cyanide, bulk, 98-99 per cent, in cases	Lb.	$ .45
Sodium Hyposulphite, kegs	100 Lbs.	2.75
Sodium Nitrate, refined	100 Lbs.	8.00
Sodium Silicate, according to density	100 Lbs.	2.50—3.75
Sulphur, ground	100 Lbs.	4.50—5.00
Sulphur, roll	100 Lbs.	4.00—4.50
Sulphuric Acid, 66°Be, carboys	100 Lbs.	3.25—3.75
Tannic Acid, commercial	Lb.	1.40—1.50
Tartaric Acid, crystals or powdered	Lb.	.80—.90
Tin Chloride. crystals	Lb.	.70
Zinc Sulphate, com	Lb.	.6½

Metals

Aluminum, No. 1, 98-99%	Lb.	.40
Antimony	Lb.	.18—.19
Arsenic, white	Lb.	.15
Brass, yellow ingots	Lb.	.18—.20
" red	Lb.	.25
Cobalt, metal	Lb.	2.25
Copper, casting	Lb.	.32
Copper, electrolytic	Lb.	.33
" Am. Government price (electrolytic and casting	Lb.	.23½
Iron, bars	100 Lbs	5.00
Lead	Lb.	.09
Magnesium	Lb.	2.50
Mercury	Lb.	1.50—2.00
Nickel, electrolytic	Lb.	.50— 55
Platinum, pure	Oz.	105.00
Silver	Oz.	.86—.87
Spelter	Lb.	.10
Steel, mild	100 Lbs	5.25
" nickel, in bars, 3½% Nickel	Lb.	.23—.27
" sheet, Bessemer, 28 gauge	100 Lbs	8.15
Tin	Lb	86.—.87
Zinc, sheet	Lb.	.25—.30

McGill Chemical Society

The officers of the McGill Chemical Society, of McGill University, Montreal, are: O. Maass, MSc., chairman, and E. G. Young, B.A., secretary-treasurer. The meetings are held every second Friday at 5 p.m. and are open to all students and to the public. The paper on "Chemical Control of Respiration," by Dr. A. W. Downs, which was to have been read before the society on February 1st, will be presented on March 1st.

Engagement Wanted

Experienced chemist desires responsible position. B. Sc. of a British University, F.I.C., and a graduate of a well known technical college; several years experience in organic research. For over five years have held present position as Chief Chemist to large firm. First-class references. Address Box 4, Canadian Chemical Journal.

Technical graduate, chemist, two years in iron and steels, etc., is open for a proposition.—Box 2, Canadian Chemical Journal.

Index of Advertisements

Recent Incorporations

Toronto.—Synthetic Drug Company, Limited. President, E. Neil Macallum. Capital, $40,000. To manufacture and deal in chemicals, particularly diarsenol and neo diarsenol.

Toronto.—Mundus Margarine Company of Canada, Limited. President, W. H. Wood, of the Commercial Acetylene Company. Capital, $50,000. To manufacture and deal in margarine and other foodstuffs and their substitutes.

Toronto.—British Molybdenite Company, Limited. Capital, $100,000. The mining and metallurgy of molybdenum and other metals and minerals.

Toronto.—The Canada Metal Company, Limited. W. G., F. and A. F. Harris. To increase capital to $1,000,000. To manufacture and deal in metals and metallic alloys.

Montreal.—Eastern Chemical Company, Limited. J. O. Dion and J. W. Dion, manufacturers. Capital, $200,000. To manufacture and deal in all chemicals including pumice stone and alcohol.

Montreal.—Canadian Die Casting Company, Limited. F. H. Markey and W. W. Skinner, solicitors. Capital, $300,000. To manufacture and deal in iron and steel from the ore to the finished product.

Montreal.—British Controlled Oilfields, Limited. G. W. MacDougall and L. MacFarlane, solicitors. Capital, $12,500,000. To do exploration and development work in oil, gas and mineral lands and to manufacture oil and gas products.

Montreal.—Russell Murray Cocoa Mills, Limited. A. Wainwright and M. C. Lalonde, solicitors. Capital, $100,000. To manufacture and deal in cocoa, chocolate and their products.

Montreal.—O'Connors, Limited. A. P. and W. P. O'Connor. Capital, $100,000. To manufacture chemicals, iron and steel and their products; to mine and smelt metals.

Ottawa.—Wood Molybdenite Company, Limited. O. E. Wood and A. McLean, mine operators. Capital, $1,000,000. To conduct a general mining and smelting business.

Brantford.—Electric Smelting Company of Brantford, Limited. A. Goodwin, H. McIntyre, J. Ker and P. H. Secord, manufacturers. Capital, $45,000. To conduct electric smelting of metals from ore and scrap. To manufacture and deal in pig iron and steel castings.

Winnipeg.—Manitoba Steel and Iron Company, Limited. President, Thos. R. Deacon, Hugh B. Lyall. Capital, $500,000. To acquire the business of Manitoba Bridge & Iron Works, Limited, and to manufacture and deal in iron and steel and their products.

Our Contemporaries

"Iron and Steel" is the title of a new monthly devoted to the basic metals named in its title. The editor is Dr. Alfred Stansfield, professor of metallurgy in McGill University, Montreal, and the associate editor, W. G. Dauncey, an expert in the metallurgy of steel, and recently connected with the Canadian Steel Foundry Company. The first number which contains 82 pages is most creditable to the publishers, the Industrial and Educational Press, of Montreal, of which Mr. J. J. Harpell is president. The subscription price is $2.00 a year. We wish this new Canadian publication every success.

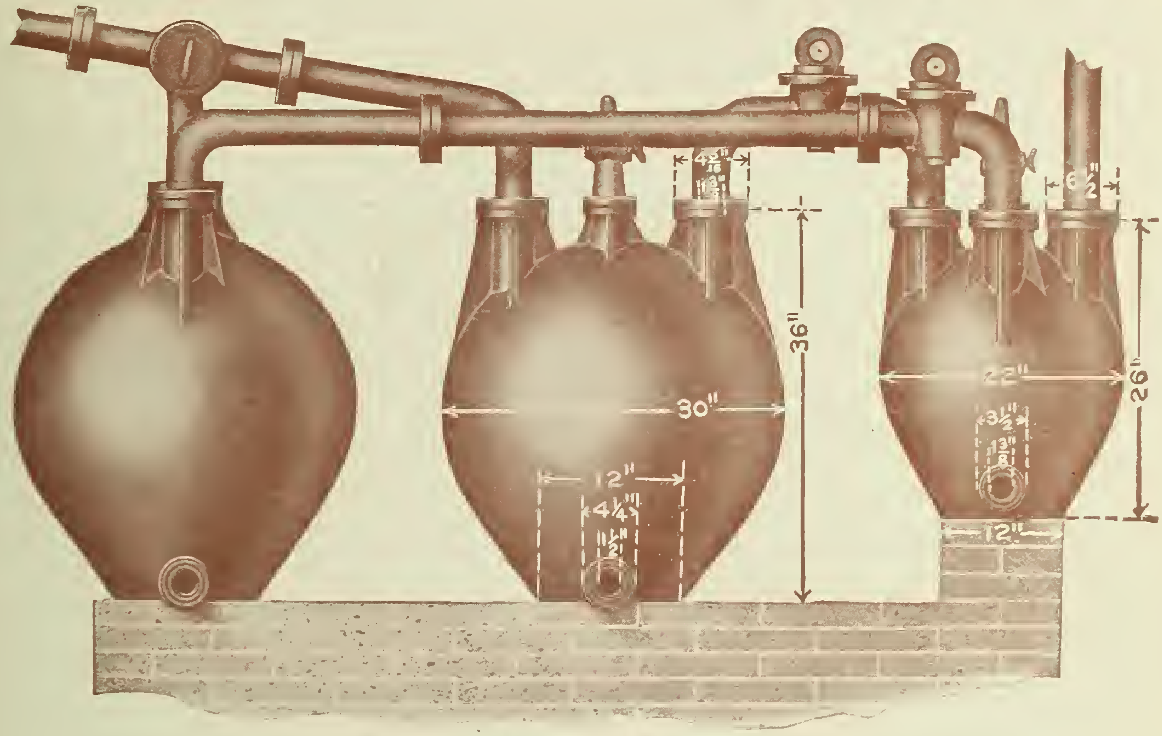
The "Canadian Products Number" (January) of Industrial Canada is a credit to the trade journalism of Canada. Besides the usual matter relating to the work of the Canadian Manufacturers Association it contains thirty special articles on as many different features of the recent industrial progress of Canada, including the chemical, mining and metallurgical industries. There are nearly a hundred pages of these articles, making an impressive symposium.

Wm. Laird Turner has been appointed editor of the Canadian Textile Journal. Mr. Turner had valuable experience in the United States as technical teacher in the Philadelphia Textile School, and in other institutions and was recently manager of the Brinton Carpet Mills at Peterboro, Ont.

Classified Index of Advertisements

Acid-Proof Chemical Stoneware

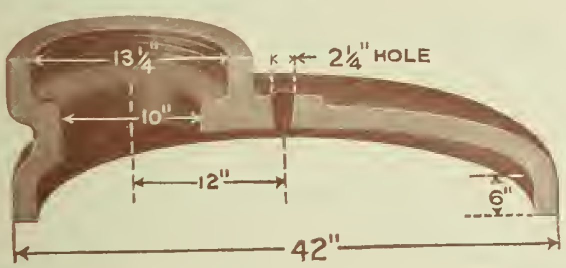
Our ware is not the cheapest, nor is it fancy—but it is made of a body and built so as to give long and dependable service under severe and various working conditions



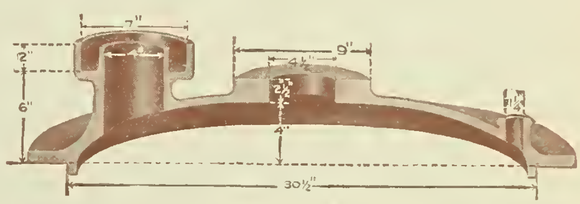
ACID-PROOF FLANGED RECEIVERS, PIPES AND COCKS
Showing Section of Nitric Acid Valentiner System.
All pipe, cocks and receivers must be perfectly vitrified throughout so as to hold 15 lb. vacuum.

All Guaranteed Acid-Proof and Vitrified Throughout—Yet not Brittle and Fragile like Glass, but Strong and Tough like Granite.

We make every description of acid-proof chemical stoneware, from special pieces to complete plants.



ACID-PROOF TOWER OR LUTE COVER
Made in any size with outlets and inlets to meet requirements.



ACID-PROOF JAR COVER
Made to fit any size jar with any size or design holes.

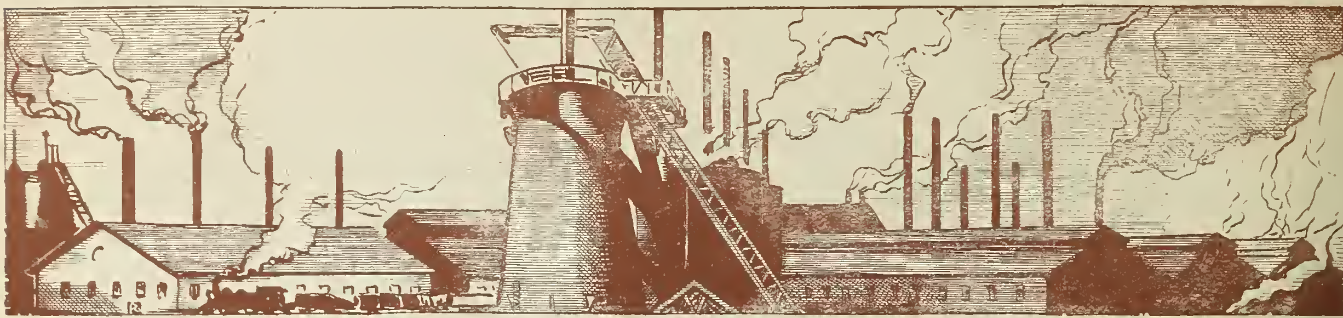
Withstands the action of Acids, Alkalis and Chemicals, strong or weak, hot or cold

IT IS THE BODY ITSELF

Let us send you circulars and particulars

MADE IN AMERICA BY AMERICANS WHO KNOW HOW

MAURICE A. KNIGHT Office and Factory Kelley Avenue **East Akron, Ohio**



CANADIAN CHEMICAL JOURNAL

A Canadian Journal devoted to Metallurgy
Electro-Chemistry and Industrial Chemistry.

Vol. II, No. 4 | TORONTO, APRIL, 1918 | 20c. a copy; $2 a year

For Index of Advertisements
See Page 42

Classified Advertisements
Page 45

PROFESSIONAL DIRECTORY

CANADIAN CHEMICAL JOURNAL

A Canadian Journal devoted to Metallurgy Electro-Chemistry and Industrial Chemistry.

Vol. 2 TORONTO, APRIL, 1918 No. 4

CANADIAN CHEMICAL JOURNAL

DEVOTED TO THE CHEMICAL AND METALLURGICAL INTERESTS OF CANADA.

Published monthly by the Biggar Press Limited

Office, 36 Toronto St., Toronto, Canada

Telephone Main 7399. E. B. BIGGAR, Managing Director

Subscription price, $2.00 per year to Canada, United States and all parts of the British Empire.

Time of going to press, 25th of the month preceding date of issue. News and changes of advertisements should be in hand one week before.

NOTICE

The Editorial Department exercises every care to ensure the correctness of the contents of the Journal. It is understood that the authors of signed articles are alone responsible for the statements they may make, whether of fact or opinion. Address all editorial correspondence to 36 Toronto Street.

Principal Contents

The Chemical Convention

AFTER facing all the difficulties the majority of the members of the various chemical organizations in Canada have decided that the annual meeting of the new formed Ottawa Section affords the opportunity to "take occasion by the hand," and bring the members and their friends together at the capital from all parts of the Dominion.

It is very encouraging to be able to state that the three organizations known as the Montreal Section, the Ottawa Section and the Toronto Section will be joined on this occasion by representatives from the Canadian Pacific (B.C.) Section, which was formed last year in direct connection with the parent society, and by the Manitoba Chemical Society, which was recently organized as an independent body. The two western organizations have shown commendable vigor along with that spirit of self-dependence so characteristic of the free air of the great West, and it is very gratifying to see, by the interest they are taking in the convention, that their independence has no suggestion of indifference to the welfare of chemists in other parts of Canada.

At the time of writing, the exact date of the convention has not been fixed, but it is very probable that it will coincide with that of the annual meeting of the Royal Society of Canada, many persons being members of both societies and there being a chemical Section of the Royal Society, while the benefits of the reduced "convention rates" on the railways would be obtained by taking concurrent dates. The Royal Society meets at Ottawa on the 21st, 22nd and 23rd of May and the last two days may be selected by the chemists.

As the Industrial Chemical organizations of Canada will at this convention begin to take on a national character as the natural feature of the remarkable growth in our chemical industries it is earnestly to be hoped that not only all chemists and students but employers of chemists will be well represented there. Employers will serve their own interestes in the highest sense by their presence, bringing their chemists with them.

Industrial Organization after the War

ONE of the most comprehensive and practical of the many good papers read before the Canadian Mining Institute at Montreal last month was that by Dr. Alfred W. G. Wilson, of the Department of Mines, on the industrial problems of mining in Canada after the war. It appears in this issue, and we would suggest that the paper or at least its subject, as far as it relates to chemistry and metallurgy, be made a topic of discussion at the convention of chemists in Ottawa.

Senator Frederic Nicholls, in a very forcible speech, recently reprinted in pamphlet form, has directed public attention to this problem from another angle, and as the head of three important industrial establishments, he gives a timely warning of the revolution that will have to be accomplished in Canadian industry if the wheels are to be kept in smooth running order in the peace adjustment after the great conflict of arms.

Everybody now realizes the over-powering advantage Germany had in the war by the training of her chemists and metallurgists and by the development of the varied industries dependent on these trained men. It has been well said that if German scientific men had not been able to produce nitrogen from the air when the supply of Chilean nitrates could no longer be had from overseas the Central Powers would have had to throw up the sponge long ago. If such was the influence of a single basic chemical how can we measure the value of the vast circle of chemical and metallurgical products that ramify into almost every fibre of the industrial organization of a nation. Great Britain and the United States now realize that the consolidation of their new position in the chemical and metallurgical industries must be the first care under peace conditions. In the case of Canada it is slowly dawning on our public men that the key to the successful reorganization of Canadian industry after the war lies in the laboratory.

Alcohol in Industry and Legislation

THE second portion of Professor Shuttleworth's carefully prepared article on spirit production for the industries appears in this issue; and in the interests of the many important manufactures in which alcohol is an indispensable requirement it is to be hoped that his analysis of the situation will be studied by public men.

The peace requirements in alcohol for a country of the population of Canada are over a million gallons a year, while Canada's present war requirements are about five million gallons, by the distilling process. Alcohol is required in the manufacture of varnishes, polishes, lacquers, shellacs, paints, stains, enamels, celluloid under its various names, oil cloth and linoleum, soap, electrical goods, alkaloids and fine chemicals and medicines, surgeons' supplies, aniline and other dyes, photographers' supplies, insecticides and disinfectants, rubber goods, silks, embroideries and artificial flowers, inks, dyeing, cleaning and laundry works, electrotyping, printing, scientific apparatus, and many other requirements. As these industries must be carried on, it will be seen that the alcohol problem cannot be dealt with from the standpoint of social legislation alone. To carry out literally the proposals now made in the name of temperance would paralyze the most essential industries. Assuming that alcohol must be produced for industrial purposes the question now being asked is, who is do the manufacturing, the distillers or the government?

It appears clear that the official reports do not furnish complete data for getting at the actual facts, but it is satisfactory to learn that this information will be furnished in future reports.

So far as concerns the production of alcohol for drinking purposes it is well for the Government to recognize that the use of private stills for illicit distilling is likely to be revived, in spite of the severe penalties. As a matter of fact the private stills which operated during the middle of the last century in quiet corners of Upper and Lower Canada have never ceased to do business in remote districts of Quebec.

The extension of the uses of industrial alcohol, including cheap alcohol for power purposes; and the possible new sources of alcohol, notably that from cellulose, are problems as interesting to the chemist as they are important to the manufacturer, and Professor Shuttleworth has rendered a public service in directing attention to these problems.

Professional Aims

GREATER professional cooperation should be the constant aim of every Canadian chemist. In the general reorganization of the nation larger opportunities are being presented to him than ever before. The situation has forced the giving of a larger measure of public recognition to his services. His duties and functions do not lend themselves to the same strict classification as do those of many other professions. However a real opportunity for more united organization awaits his profession and it is a question if the average member is awake to the situation. It is the duty as well as the privilege of every chemist to step out more freely and enter into that larger field of general affairs of state so long closed to him. To a certain extent the activities of the average chemist tends to narrow down his viewpoint. His work in the past has done more to enslave him than it has to broaden him out. A man loses much by getting out of contact with the every day world. In a sense a profession may be measured by the number of its members who have been not only

successful in their calling, but also have found time to develop themselves along other lines. The study of science and technical training in general should cease to be such a complete end in itself and might well become the stepping stone in many instances to broader, larger fields. There is no reason in the world why a chemist should scorn those opportunities which tend to bring prestige to other professions. The confidence of the great mass of the people must be intrusted eventually to expert technical opinion. There is no valid reason why there should be so many middle men involved in this transaction. To this end the leaders in chemistry and science should strive toward common ground with the leaders in political and industrial life. If more of these positions were interchangeable it would greatly assist this movement. In order to accomplish their share of this work properly chemists must bring with them a strong and sane organization of their own, capable not only of talking about things but also able to do things. They should as it were begin to comb their hair, grow corpulent, and have their viewpoint tabulated up along with those from which the destinies of the state are chosen. Certainly the possibilities arising from the application of applied chemistry in our country are wonderful enough, but the concept still needs missionaries.

IT is fortunate for the younger generation of chemists that there are in Canada men like Mr. M. L. Davies, of the Standard Chemical, Iron and Lumber Company, who take pleasure in giving words of cheer to the students, such as he gave to the Industrial Chemists' Club of the University of Toronto. Such encouragement will tend to attract the better type of young men into the field of applied chemistry and will raise the status of the whole profession.

IT is sobering to reflect that the instruments which have wrought so much bloodshed and destruction in the great battles of March have been primarily the devices and inventions of the chemists and metallurgists. The awful carnage and devastation have demonstrated that science may be fiendish or beneficent in its results, depending on the spirit which governs its application. We should pray God that good will in government may be the impelling motive that calls for the gifts of science after the detritus of this war is cleaned up. So far, under the evil genius of those in power, science seems only to have smitten the whole earth with a curse. It will be for the younger generation, inspired by "good will to men," to rebuild on a better foundation if the wilderness is to be made like Eden.

The New British-Canadian Intelligence Service

The creation by the British Government of a Department of Overseas Trade (Development and Intelligence) is an important matter which has as yet received comparatively little attention in Canada. As pointed out in a recent issue of the official Board of Trade Journal, the war, instead of exercising a disruptive influence on the British Empire as predicted and hoped by the enemy, has led to a keener realization of the strength of the ties, both moral and material, which bind the various portions of the Empire together. "Out of this realization," says the Journal, "has sprung a growing consciousness of the need for a closer co-operation in all things that matter between the States of which the Empire is composed. It is appropriate that at such a time comprehensive action should be taken with the direct object of fostering and developing inter-imperial trade. The recent establishment of the Department of Overseas Trade (Development and Intelligence) and the improved and extended service which it will provide at home is a necessary preliminary to any such action; for an intelligent development of trade relations within the Empire must depend upon the fullest possible knowledge of industrial requirements and industrial capabilities of this country. The reorganization in the United Kingdom is to be supplemented by a large extension of the service of His Majesty's Trade Commissioners in the Empire."

Fred. W. Field
New British Trade Commissioner for Ontario.

In that extension, Canada is particularly interested. Heretofore British trade has been represented here officially by only one Commissioner. Now three are to be resident in the Dominion, the Senior Commissioner at Montreal, another officer at Toronto, and the third at Winnipeg. Mr. G. T. Milne has been appointed to the Montreal position in succession to Mr. Hamilton Wickes, who remains in England. For five years Mr. Milne has held a similar office in Australia and he is, we understand from London advices, a capable and experienced officer. The Province of Ontario will, for this extended service, have Toronto as its headquarters, with Mr. Fred W. Field in charge. Mr. Field has edited The Monetary Times for thirteen years and is recognized as one of our leading financial and commercial authorities. As we stated in noting his appointment a month ago, no man in Canada is better qualified for the post, either by knowledge of trade conditions in Canada and Great Britain or by genialty and integrity of character. He has for many years participated in confidential conferences from time to time with the leading men, financial and business, of the country. It is pleasing to know that the British authorities have obtained

the services for Canada of such men as Mr. Field and Mr. Milne, the former having been a resident here for many years.

Mr. Field has established his official headquarters in the Confederation Life Building.

The United Kingdom, through its trade commission service, and in other ways, will have a remarkably efficient commercial intelligence service in full operation even before the war is over.

From what we read in the English papers, it is not too much to say that the British service will be better than that of any other country. Its work at the close of the war will be invaluable.

As a final comment on the value of the Trade Commissioner Service, attention may be called to the following resolution passed unanimously on the motion of General Smuts at the Imperial War Conference in April last: "The Imperial War Conference welcomes the proposed increase of the Board of Trade service of Trade Commissioners and its extension throughout the British Empire in accordance with the recommendations of the Dominions Royal Commission, and recommends that the Governments concerned should co-operate so as to make that service as useful as possible to the Empire as a whole, especially for the promotion of inter-Imperial trade."

The new department will be represented in the Imperial Parliament by Sir Arthur Steel-Maitland, M.P., who will occupy the position of Additional Under-Secretary of State for Foreign Affairs and also of Additional Parliamentary Secretary at the Board of Trade. Sir William Clark, K.C.S.I., C.M.G., has been appointed Comptroller-General of the new department, and Mr. F. G. A. Butler, C.B., C.M.G., formerly of the Colonial Office, has been appointed Director of the Overseas Division.

The Universities and the Industries

By John Waddell, D.Sc., Ph.D., Chemical Department Queen's University, Kingston

I do not intend to enter upon an extended discussion of the many points of contact between the universities and the industries. It is a platitude that the developments in pure science carried out by the researches either of professors during their spare time, or of a more leisured class who can devote their whole energies to the investigation of nature, lead often to results of the greatest commercial value or practical use. When Faraday discovered that lines of magnetic force cut by a metallic wire can produce an electric current, he was far from anticipating the dynamo with its tremendous output of horse power; but so great a tree has grown from so small a mustard seed.

Roentgen, when he began his scientific investigations along the lines marked out by Crookes and Lenard was not looking forward to beginning a new epoch in surgery and medicine, though that was one of the results.

There have been those who were equally at home in pure science and its applications. Lord Kelvin is probably the most famous example, being a most brilliant investigator in both departments; while on this continent Professor Rowland, of Johns Hopkins, was eminent both in the theoretical development of pure physics and in its adaptation to commercial ends.

It is one of the functions of the university, in its relation to industry to provide for men (and in these days, for women) such a training in the principles of science as will enable them to undertake with intelligence, and some degree of manipulative skill, the department of work which they make their profession; and to give them such an acquaintance with the methods for getting information from books as will enable them to take full advantage of the literature at their disposal.

Moreover, students and graduates who show special aptitude for research should have, in the university, opportunities for following their bent and of increasing their powers for original investigation. These men when they leave the university and go into industrial work will be well prepared to attack the problems that come up from time to time.

But there are industries (and it is these whose relation to the universities I wish to make prominent) in which such fully trained men have not been secured, and their scientific staff may be unable to attack the problems that confront them at times, though they can carry on the routine work fairly well. These industries could gain from the colleges and universities by applying to them for help. I am not now referring to expert advice on matters of great money value to an industry. For instance if there is a breakdown in an electrical equipment that cannot be remedied by the electrician, an outsider brought in naturally expects to be paid well for his advice. Prof. Rowland is said to have charged a company a large sum for advice given, and when objection was raised to the amount, he pointed out that the advice was worth to the company, many times what he had charged for it, and that there were very few in America who could have solved their difficulties for them.

There may, however, be minor problems which would need a little investigation and whose solution when worked out would be of advantage not only to the particular company bringing up the matter, but to others as well. These problems might well be brought to the universities in some way.

Perhaps I may be allowed to give a personal experience in illustration of what I mean. Several years ago, I saw a method for the determination of lead which attracted me on account of the chemical principles involved and which I introduced into my course in quantitative analysis. I found, however, that the students had difficulties and that their results were not concordant. I therefore spent two or three hours a day for a fortnight or so during vacation, trying over the method with a student who had just graduated. We discovered the sources of the various difficulties and provided remedies; and now I expect students working over this method for the first time to get duplicate results to agree to within a few hundredths of one per cent. I have heard that the original method had been adopted at some smelters and had been given up, probably on account of the difficulties that my students encountered.

If I had not been drawn to the method for instructional purposes, I should not have known that it needed revision. Where, however, lead ores are often analyzed, it is natural to suppose that the method would be tried and if the routine analyst had realized that it was possible for him to get help he might not have permanently thrown aside the method, but might have submitted it for investigation.

This winter, some students in my laboratory in carrying out their prescribed course of analysis, have investigated the inaccuracies of the Canby modification of the Pearce method for arsenic; and though the work is not yet complete it seems likely that they will reach a satisfactory conclusion.

The instructional staff in the universities might often be of use to those engaged in the industries if they were made aware of their problems, though they would not naturally seek out these problems themselves.

The physical, chemical and engineering staff of the university might often be appealed to with advantage. Naturally, the investigator of the problem would be free to publish his results, if he wished to, and if in the course of his work he is led on to further developments he would be entitled to gain whatever advantage he could from them.

Canada must prepare to hold her own in the great economic struggle that will follow the war. This cannot be done unless the industries of all kinds are properly developed. These industries cannot be developed in a haphazard manner, but by the intelligent application of scientific principles and it is natural to look to the universities for help along this line. The industries should apply to the universities, either directly or through the Honorary Advisory Council for Scientific Research in Canada, at Ottawa. So far as chemistry is concerned, The Canadian Chemical Journal would afford an additional excellent channel of intercommunication between the industries and the universities and it is to be hoped that it will be extensively used in this way.

Nitrogen and Its Compounds*

By Horace Freeman, Niagara Falls, Ont.

In the early days of the war when Admiral Von Spee with his squadron of German ships sailed the Pacific Ocean from Alaska to the Falkland Islands and defeated Sir Christopher Craddock at the battle of Coronel, few people actually realized the significance of his movement and the danger in which the Allies were placed by his temporary blockade of the Coast of Chile. Chief among those who did, however, was Admiral Sturdee, upon whom some critics place the blame for Craddock being outclassed in ships and guns, and who himself set sail secretly to meet the victorious Germans and accomplish their complete defeat at the Battle of Falkland Islands.

For in Chile lies the world's one great natural deposit of combined nitrogen and upon this even yet the Allies are dependent for their supply of explosives and fertilizers. It is an open question whether or not Von Spee hoped successfully to maintain this blockade, but possibly he expected aid from Germany for this purpose. Certainly had he succeeded in capturing the Falkland Islands and maintaining a base of operations there effectively he could have captured or sunk a great portion of the ships carrying nitrate from Chile to Europe.

There is this difference between the Allies and the Central Powers, that whereas the Allies are almost completely dependent upon the natural nitrate of Chile for the production of explosives and many other important substances necessary for our welfare, the Central Powers manufacture theirs from the nitrogen of the atmosphere.

Nitrogen is one of the most abundant elements for it comprises seventy-five per cent. of the atmosphere which we breathe. It is also one of the most inactive or inert, as chemists say; that is to say, it possesses no disposition to combine readily with the other elements, which go to make up the universe, and it is this inertess which has occupied scientists for nearly a century. The abundance of nitrogen has long been known, but the importance of compounds of nitrogen has only forced itself upon us within the last twenty-five years, and has only become acute since the beginning of the war.

The element nitrogen is the most important of all plant foods. Few plants are able to absorb it directly from the atmosphere; among these few are peas, beans, vetches and clover. Their action is exceedingly slow, too slow for the present day demands of agriculture which cannot afford under modern conditions to have a large percentage of ground devoted to the growth of leguminous plants in order later to plough these in, so to supply food crops of a more important nature with the combined nitrogen necessary for profitable yields. Food crops grown in succession rapidly remove the nitrogen from the soil. This nitrogen gives us our nourishment and to a very large extent gauges the value of food. This is true even of the flesh we consume, for it also obtains its nourishment from the soil.

Stable manure applied to the soil supplies some of the nitrogen in the form of compounds which are available to plants, but this method of fertilization is at best a very inefficient return to the ground of that which originally came from the ground.

Coal contains nitrogen and a portion of this is available in the form of ammonium compounds which are obtained from gas works and coke ovens, but even this source of suitably combined nitrogen, vast as it is, does not nearly supply the agricultural demand to say nothing of the multitude of other requirements. Moreover, the cost of obtaining this nitrogen from the coal in forms in which it can be sold, while not prohibitive, is such that cheaper and more abundant supplies must be obtained to meet the rapidly increasing demands. Fertilizer must be cheap, the cheaper and more abundant it is the better for the cost of living.

Thus it is that the great deposits of nitrate of soda in the soil of Chile have been developed from a production of 900 tons in 1830 to a production of 2,500,000 tons in 1912. The soil in certain rainless districts in Chile contains from 7% to 20% of sodium nitrate, which is supposed to be the result of decay of the vast beds of seaweed carried by the storms of the Pacific onto the land, which has since been upraised by subterrestial action until it lies on a high plateau, safe from the action of the sea. The nitrate is extracted from the soil by the simple method of dissolving it in water. These deposits of Chile are by far the largest in the world, and it is unlikely that any other of a similar nature will be found. They have been exploited by British and German capital and luckily for us the fight for control in this field was not won by Germany.

Chilean nitrate besides being the great source of fertilizer nitrogen supplies the Allies with by far the major portion of fixed nitrogen which enters into the composition of all military explosives, and without it the Allies would be fighting a very poor defensive, and their big guns would be useless. All modern explosives are made with nitric acid and all the nitric acid used in England and France at the outbreak of war was made from Chilean nitrate and in fact practically all the acid used by them to-day is obtained from the same source, thanks to the Navy.

But many years ago Germany realized that she could not hope to conduct a great war if she were not independent of this raw material for her explosives, and her scientists have received the encouragement of their government in their endeavors to find means whereby in case of blockade their country would be able to supply its soldiers with food and munitions independently of any outside source. This was part of their preparation for "the day," and we know only too well how successful they have been in this direction.

The nitrogen of the air is their raw material. Scientists of all the great nations have sought for a century the means whereby this great reservoir might be made to yield its life sustaining and life protecting elemental nitrogen in forms suitable for the purposes mentioned. Before the war the increase in the world's population urgently demanded the solution of this problem, but nowhere was its solution sought so energetically and imperatively as in Germany, whose Empire is not so large as the Province of Ontario.

The Chilean deposits cannot last forever. It is thought that they have reached the maximum development and in fifty or a hundred years will be played out. In any case the cost of producing nitrate from the lower grade deposits is bound to increase while the world's demand for combined nitrogen is increasing more rapidly than the population as the uses of nitrogen compounds become more and more manifold.

A few figures compiled by Sir William Crookes in 1898 will show how imperative it is that cheap and vast quantities of fertilizer be available for the use of the world's population.

He calculated that there were 515,000,000 bread eaters in that year and they were increasing at the rate of 6,000,000 a year. Each of these consumed 4.6 bushels of wheat and the average yield per acre of ground under cultivation was 12.8 bushels.

By 1941 the wheat fields of the world would cover 292,000,000 acres in order to feed 819,000,000 bread eaters, with bread alone. This calculation concerns only wheat consumption; it does not take into account the meat and many other kinds of food which we eat.

Such figures make us wonder how the population of the world five centuries hence will derive its sustenance, but Nature provides a solution for all problems of this kind. In the ordinary course of life man does not seek these solutions until circumstances force the necessity upon him. The nitrogen problem is one of the great exceptions, and to-day we may safely say that the

* An address read before the Board of Trade of Niagara Falls, Ont. The author spent several years in research work in England upon the production of cyanides from nitrogen, and some years in research work on the same subject in Canada. He is now in charge of the cyanide department of the American Cyanamid Co.'s works at Niagara Falls, Ont.

means are at hand, in operation in fact, whereby we may draw upon the vast and limitless stores of nitrogen in the atmosphere for our purposes.

The air over each square mile of the earth's surface contains about 20,000,000 tons of nitrogen in the elemental or uncombined state. The world is using this amount of nitrogen in the form of chemical compounds every fifty years at the present rate of consumption, and up to the last ten years practically none of this has been derived directly from the atmosphere.

Recognition of these facts has been brought to the attention of the countries of Europe and America by the demands of warfare in a manner that has caused each country to seek to provide the means within its own boundaries of securing its foodstuffs and munitions from the storehouse which has no boundaries to blockade.

A veritable army of workers in most branches of science have contributed to the solutions now at hand. The credit does not belong to any one man or country. It is but natural to expect the practical solution to have come from those countries possessing the most congested populations, but the practical solution of necessity only followed the result of pure scientific research conducted wherever research institutions could be found.

Early Attempts to Utilize Atmospheric Nitrogen

The earliest attempts to utilize the nitrogen of the atmosphere were made with the object of producing Prussian Blue, which is used chiefly for calico printing and as ordinary laundry blue. The first process was carried out in Paris, and in Newcastle by Bramwell and Company in 1838, and consisted in passing air over a mixture of charcoal and carbonate of potash, in retorts at a high temperature. By this means potassium cyanide was obtained in the product and this substance was then converted to potassium ferrocyanide by boiling with a compound of iron. The potassium ferrocyanide was then used for the preparation of the Blue.

This process has been revived with many improvements up to the present day and always with the same result, positive commercial failure due to the reluctance of the nitrogen to combine with the chemicals used for the purpose, the short life of the plant due to the fluxing action of the alkaline potash on the retorts or furnaces at the temperature above a red heat and the high working cost on a product containing only a very small amount of combined nitrogen.

An attempt was made about 1860 by Marguerite and de Sourdeval to use barium carbonate for the same purpose in place of the potash in order to prolong the life of the apparatus. It proved very much more successful as an absorbent of nitrogen and a much richer product was obtained. But still the retorts which were externally heated had a very short life and this method was abandoned. It was revived again by the Scottish Cyanide Company about 1895, which used a mixture of barium carbonate and coal, heated internally by a current of electricity passed through it in the retorts. Nitrogen in the form of producer gas was passed through the heated mass and was absorbed to a considerable extent. The product contained both barium cyanide and barium cyanamid. The cyanide only was extracted and the cyanamid was wasted, consequently the process was not commercially successful.

The results of this work and much other of a similar nature nevertheless proved so encouraging that more workers came into the field. At this period the introduction of the cyanide process of extracting gold and silver created a demand for sodium and potassium cyanide, and this formed the chief encouragement for many workers in France, England and Germany.

In England, despite the failure of Marguerite and de Sourdeval, the barium process was revived once more, using externally heated retorts made of graphite. Even these costly pieces of apparatus would not stand up under the action of the semi-fused masses and this process has now been finally abandoned.

The Discovery of Cyanamid

In Germany the chemists, Frank and Caro, still seeking a cheap method of producing cyanide, sought to pass atmospheric nitrogen over various metallic carbides and their patents describe the use of barium and calcium carbide for this purpose and even of alkali metal carbides. The alkali metal carbides it may be mentioned do not exist, and there are good reasons for believing that they will never be prepared except as chemical curiosities. However, Frank and Caro concentrated upon the use of the cheap calcium carbide with the sole object of producing calcium cyanide, a substance which cannot exist in the dry state. Their product they eventually found to be Calcium Cyanamid. Its value as a solvent for gold and silver is nil, but its value as a fertilizer was soon proven, and Frank and Caro realized that they had solved the great problem—the production of nitrogenous fertilizer from the nitrogen of the atmosphere. They immediately abandoned their object of cyanide production and developed the manufacture and use of Calcium Cyanamid for a fertilizer, this being by far the larger prize.

The Development of the Arc Process

The atmosphere contains oxygen mixed with nitrogen and contemporaneously with the work of Frank and Caro many attempts were made to convert the atmospheric mixture into a chemical compound by bringing these two gases into chemical union. The earliest observation in this connection is that of Cavendish made in 1785, who found that when electric sparks were passed through air an acid was formed. The explanation of this phenomenon was published by Bunsen in Germany in 1857, and it is the same principal which is used to-day on a large manufacturing scale in Norway, as a result of a century of research. It is interesting in this connection to find that the very first industrial attempt to make use of this reaction was made by a Frenchwoman, Madame Lefebre of Paris, who secured a patent in England in 1859, covering the production of nitric acid from the atmosphere by means of electrical discharges.

This method of utilizing the atmosphere was destined to wait upon the results of practical application of hundreds of clever inventions. Its history is the history of electrical development. The first large scale development was erected at Niagara Falls. The means adopted here under the patents of Bradley and Lovejoy consisted in passing the air through millions of electric arcs which rapidly heated it to a high temperature. The cost of power even at Niagara Falls and the wear and tear of the apparatus caused this works to close in 1904.

At this same period the process received the attention of two Norwegian scientists, Birkeland and Eyde, who used the electric arc placed between the poles of a powerful electric magnet. Under these conditions the arc makes a disc of flame and maintains itself in rapid motion, and is greatly enlarged. This gave an advance in the economy of power, but although the original works built by Birkeland and Eyde in Norway have developed to a very large scale the consumption of energy is too great to admit of the process being developed in America. It owes its success in Norway to the easy and cheap electrical development of natural cascades close to the Norwegian tidewaters. At this Norwegian works the air is passed rapidly through a series of arcs and is rapidly cooled. 35,000 cubic feet of air are used per minute and brought to a temperature of 3,000 degrees centigrade, a temperature which, if observed with the naked eye, would soon render one blind. After the gases are cooled they contain nitric oxide as a result of the union of the oxygen and nitrogen, and this is absorbed in lime to form calcium nitrate or is absorbed in water to make nitric acid. A large portion of the output is made to combine with ammonium nitrate, a substance which has wide use in the explosives industry.

The two processes just outlined—the cyanamid process and the arc process—both require considerable amounts of power for their commercial operation, the arc process requiring five times the amount of power that the cyanamid process demands in

order to produce the same quantity of fixed nitrogen. Consequently, they are both unsuited for countries such as England and Germany, which do not possess the means of producing power in competition with more favored regions of Europe. such as Norway, France and Northern Italy. Germany would doubtless like her place in the water as well as in the sun, but, to give her credit, she has sought means for combining nitrogen without the use of large amounts of power, and England, too, under the incentive of war conditions, is now vigorously researching to the same end. Germany has produced the Haber process which requires only sixty per cent. of the power used by the cyanamid process.

The Haber Process

The Haber process causes nitrogen prepared from the atmosphere to combine with hydrogen gas forming ammonia from which fertilizers and explosives are prepared. This method is receiving a trial in England, but its commercial success has not been definitely established under conditions of peace. The details of its operation are not widely known. but the nitrogen and hydrogen gases used must be extremely pure and free from oxygen. They are compressed into steel cylinders under a pressure of eighteen hundred pounds to the square inch. These cylinders hold what is called a catalytic agent, in this case uranium, osminum or metallic finely divided iron, and they are heated to a low red heat. Under these conditions the gases combine to form ammonia, which as it issues from the cylinders may be condensed to make anhydrous ammonia, or oxidized by admixture with air and passing over heated platinum gauze to form nitric aicd, a process described later.

The high pressure used and the nature of the gases require the closest supervision of the Haber process and as explosions are somewhat frequent the apparatus is fitted with an elelaborate system of automatic alarms and bells to give warning of any untowards happening in the compression plant, which is placed out of doors in concrete pits. The capital outlay on the plant is larger than that required for the Cyanamid process or the arc process. The sole product of the Haber process is ammonia. To make it available in forms which are demanded by explosives manufacturers the ammonia gas must undergo a process of oxidation known as the "Ostwald process." It is thereby converted to nitric acid.

Nitric acid may be produced from any pure ammonia gas irrespective of its source. Calcium cyanamid is now in successful commercial use as a source of ammonia gas for this oxidation process so that a great outstanding benefit of the development of the Cyanamid industry in America is that this country has the means at hand fully developed for supplying its munition makers with their nitric acid and ammonia nitrate. This without loss of time for experimentation on only partially developed processes.

Of the three processes for fixing atmospheric nitrogen the Cyanamid process has received the greatest development, and a number of reasons account for its success. The ease and rapidity with which calcium carbide will absorb nitrogen, the high percentage of nitrogen in the product, and more than all the facility with which cyanamid may be converted into practically all the forms of nitrogenous compounds in common use to-day, and even many others which are not in common use give this process an advantage and unquestionable stability over the arc and Haber processes.

Establishment of the Cyanamid Process in America

The Cyanamid process requires large amounts of cheap electrical energy for its operation and for this reason it has not been developed in England, which has no water powers, although the improvements in steam engineering and gas engine developments might yet allow of its introduction there, especially if some concerted movement should take place for the more direct development of power at the coal pit or even in the mine itself.

The cyanamid process is the best adapted for the conditions and requirements of North America, and was chosen after exhaustive investigation of the different processes in Europe, in 1907 by Mr. Frank S. Washburn, who went abroad with the object of securing the most effective process in order to make a profitable market for a proposed power development in Alabama. The patent rights were purchased for this purpose in 1907 by the American Cyanamid Company.

The establishment of the first, and at present only factory for the fixation of atmospheric nitrogen in America or the British Empire at Niagara Falls, Canada, by this company was due to the failure of negotiations for the development of hydro-electric power in the United States, and to the cheap power offered at that time in Canada. When in 1913 capital was obtained in London for the extension of the industry to Alabama, where it was originally intended to go, similar conditions prevailed and the Canadian plant was extended by the expenditure here of some millions of dollars. There is at present practically no market in Canada for the products of the plant, which find their way to the United States and England, chiefly at present in the form of materials for munitions of war, but its operation has been of inestimable benefit to Canada, and particularly to the community of Niagara Falls. The factory has been enlarged by additions of capital to a possible capacity of 64,000 tons of cyanamid per annum, and it is a matter of regret for ourselves, as well as for the company, that owing to the shortage of power the Hydro Commission has reduced the power available for this important manufacture of fertilizer and explosives materials.

Since the commencement of operations in 1909 the American Cyanamid Company has energetically sought the maximum development of the possibilities of Cyanamid in many fields, and at this plant a great amount of technical work has been carried on under the direction of Dr. W. S. Landis, and the use of cyanamid has been extended into many arts. The plant is up to date in every respect. Its employees are better paid than those of any other similar factory, and their welfare is taken care of by a very effective safety committee, whose endeavors have made conditions of working far better than those in the majority of chemical factories.

(Concluded in Next Number)

American Institute of Electrical Engineers

If nearly fifty per cent. of the local members of a society attend the meetings to hear a technical paper and twenty per cent. of these take part in the subsequent discussion it is safe to say that the Society is a live one and is doing good work. This is the record of the Toronto Section of the A.I.E.E. in regard to the meeting which assembled on March 15th to welcome Mr. J. J. Frank, of the General Electric Company, Pittsfield, and to hear his paper on "Modern Transformers." The speaker traced the development of this form of electric apparatus from its very earliest stage and the lecture was made more instructive by a series of lantern slides.

The next meeting of the Toronto Section is to be held at the Hydro Electric Laboratories on Strachan Avenue, Friday, April 5th, when Mr. W. P. Dobson is to read a paper on high voltage testing. Few are aware of the magnitude of the work undertaken by the municipal laboratories, and in this respect Mr. Dobson's paper with its accompanying demonstrations will be especially instructive.

The operation of the new Canadian works of the International Nickel Company at Port Colborne has been delayed owing to the difficulty of getting machinery orders filled, but it is expected that work will be started by June or July.

The plant of the Canadian Milk Products, Hickson, Ont., Limited, is being enlarged to double its present size for the production of Klim described in the last number of this Journal. Practically all of the milk in this section is delivered to the Klim plant. It is estimated that 30,000 gallons, or the yield of 10,000 cows, will be dried daily into milk powder this summer.

Government Publications

By L, E. Westman, M.A., Inland Revenue Department, Ottawa.

[Notice.—Recent Government publications of scientific, technical, or educational value are reviewed here from month to month. Unless otherwise stated these publications may be obtained free, by those interested, upon application to that department of the Government publishing the same.]

Department of Interior

Water Power Branch—

Water Resources Paper No. 3. Winnipeg River Power and Storage Investigations. J. T. Johnson, 2 Vols., 500pp; 55 topographic sheets. The problem of cheap power and fuel presents more natural difficulties to the Province of Manitoba than to any of the others. This report forms a most exhaustive treatment of the power possibilities of this district and their relation to future industries centered in Winnipeg and Manitoba.

Water Resources Paper No. 17. Canadian Hydraulic Power Development and Electric Power in Canadian Industry. C. H. Mitchell, 54 pp. A general review of Canadian water power possibilities.

Department of Mines

Geological Survey—

Memoir No. 99. Road Material Surveys in 1915. L. Reinecke, 139 pp. The question of national highways between the larger cities of Canada will become in future an important part of any general scheme of transportation. The available road materials for a highway between Ottawa and Prescott as well as between Hull and Montreal have been examined. The districts reported upon have special claims for improvement and this publication is of value to any official or engineer dealing with the same problem in other parts of the country.

Mines Branch—

Bulletin No. 19. Test of Some Canadian Sandstones to Determine Their Suitability as Pulpstones. L. H. Cole, 1917. Samples of pulpstones were procured from districts in Ontario, Quebec, and Maritime Provinces. These were tested against standard imported stones. A description of the wood pulping process by sandstone is given as well as method of testing stones. Tests applied were granulometric analysis, hardness, toughness, and microscopic structure. It would appear that a fine opportunity is open for the introduction of Canadian stones on the Canadian and American markets. Canadian samples stood up very favorably with the best imported stones. The natural supply is sufficient and their introduction assured if given a fair and unbiased trial.

Bulletin No. 16. Mineral Springs of Canada. Part 1. The Radioactivity of some Canadian Mineral Springs. John Satterly and R. T. Elworthy. 57 pp., 1917. Examination was made of some sixty-four springs in Ottawa, Caledonia, and Montreal districts. A special examination was made of the Hot Springs of Banff, Alberta. Dissolved radium emanation and dissolved radium salts were measured. This is the first time that work of this nature has been undertaken in Canada on such a scale and detailed methods of procedure are given as well as much comparative data. No Canadian springs were found to be of commercial value as the quantity of dissolved radium salts is exceedingly small. The theraputic value of some of the waters may be due in part to their content of dissolved radium emanation. The Banff waters were found to be more radioactive than waters in the East. Giving sea water a value of one unit of radium per litre the average Canadian spring gave about 3 units. The highest Eastern Canadian spring (Philudor St. Hyacinthe) contained 46 units of dissolved radium. Seven springs at Banff ran from 221 to 640 units per litre of dissolved emanation. In comparison with the most radioactive waters known—those of Joachimsthal, Bohemia,—these values are very small. This Bohemian water carries 70,000 units of radium emanation per litre. This report is a very valuable contribution to scientific investigation in Canada.

Iron Ore Occurrences in Canada. 2 Vols. E. Lindeman and L. L. Bolton. Description of Principal Iron Ore Mines, 70 pp. Supplemented with 22 maps. Iron ore produced in Canada in 1916 amounted to 339,600 short tons. Ontario produced 320,487 tons. Over a million tons were used in Ontario blast furnaces. The imported ores came from the United States, Lake Superior District. The development of the Wabana ore deposits in Newfoundland has completely closed production in Eastern Canada. The Wabana field produces 5,000 tons of ore per day and has a capacity when developed of 10,000 tons. The ore is at sea level and can be loaded at the rate of 10,000 tons in five hours. This ore is of non-bessemer grade and has the reddish brown color of amorphous hematite. These ore beds are of high grade for sedimentary deposits and form one of the most compact ore reserves in the world. They can more than meet the competition of any Atlantic port in Europe or America. Cantley, 1911, gives an average analysis: iron, 53.86%; silica, 9.48%; sulphur, 0.018%; phosphorus, 0.850%; alumina, 3.55%; lime, 1.81%; magnesia, 0.84%; manganese, 0.65%; loss on ignition, 4.30%. It is predicted that after a more complete survey of the resources smaller prospects may again become productive in Eastern and Western Canada.

Department of Inland Revenue

Bulletin No. 379. Black Pepper. The analysis of 345 samples sold in Canada. In 1887 83% of samples collected were found adulterated. This high percentage has been steadily reduced to 13.8% in 1917. 48 samples were found adulterated. Names of vendors are given. It is suggested that 7% be taken as the upper legal limit for total ash in black pepper.

Bulletin No. 382. Liniment of Camphor. 94 samples were examined. Of these 39 samples were found to contain less than 18% of camphor. A standard liniment should contain 20% of camphor. The B.P., 1914, requires olive oil as a solvent, but it is considered wise to allow the use of cotton seed oil in Canada. Many samples were found to contain less than 10% of camphor. This is grave evidence of carelessness or worse on the part of the retail drug trade in Canada.

Bulletin No. 380. Headache Powders. These are classified as containing acetanlide, phenacetin, both acetanilide and phenacetin, or asperin. Adulteration consists in the presence of more than the permissible amount of the active drug, without declaration of its presence on the label. The minimum doses or their equivalent in admixture stated in the B.P., 1914, are official, without declaration. Fifteen samples from 102 were adulterated.

Bulletin 391. Canned Fish. Examination of 275 samples of this product as sold in Canada. Eighteen varieties were found on the market. Suggestions to canners regarding labels are given.

Bulletin No. 390. Flavoring Syrups. G. H. Brother. An examination of syrups and preparations used in soda fountain beverages. Synthetic preparations may be used when properly labeled. "Imitation" or "Artificial." The subject of artificial coloring in such products is dealt with. The following flavors were examined: strawberry, pineapple, cherry, lemon, orange, raspberry, vanilla, chocolate, and peach. A typical example of the conditions found. "In the twenty-seven samples of strawberry flavoring examined, 2 were found to be synthetic preparations; 2 doubtful; 23 genuine; 8 samples containined no preservative; 14 small amounts of soda benzoate; 2 salicylic acid; 2 formaldehyde, and 1 alcohol. Of the 18 samples which were artificially colored, but 6 contained an uncertified dye."

Department of Customs

Unrevised Monthly Statement. Imports and Exports, December, 1917, price 10 cents. $1.20 a year. Statement covering the month published and nine months preceding. A detailed guide of the status of every industry.

Commission of Conservation

Problems Relating to the Mineral Industry of Canada. W. J. Dick. Reprint from Eighth Annual Report Commission of Conservation. Stern necessity only has forced the allied nations to turn to the engineer and technical man for vital assistance in maintaining the whole national fabric. In future the various Governments must be more active in directing detail in the growth of any industry. The various departments of the Canadian Government have not correlated their work sufficiently well. In future they must cooperate with each other as well as with the producer and consumer. Basic industries should be established in preference to those highly specialized. The following basic mineral industries are discussed: 1. Chemical Industry; 2. Iron and Steel Industry; 3. Smelting and Refining Works; 4. Coal Trade. The future possibilities of industrial alcohol are dealt with.

Department of Agriculture

A report on "Nitrogen Compounds in Rain and Snow," forming a valuable addition to Canadian agricultural and hygienic research has been published recently by Dr. F. Shutt, M.A., D.Sc., and R. L. Dorrance, B.A., from the Central Experimental Farm, Ottawa. The analytical record of each, rainfall and snowfall for a period of ten years has been tabulated and some rather remarkable and novel data has been secured.

Nitrogen was determined in its various combined forms as: free ammonia, albuminoid ammonia, nitrates, and nitrites. The agricultural significance of this study is self-evident when it is remembered that nitrogen under ordinary methods of farming soon becomes the limiting factor of soil fertility. On the average during each year of the period, 1908 to 1917, 6,583 pounds of nitrogen entered the soil from rain and snow per acre. It was found also that during the months of April and May, when additional fertilizer is most needed, the largest amounts of nitrogen were supplied. This nitrogen being found present chiefly as free ammonia and nitrates becomes available immediately.

Atmospheric conditions were found to influence largely the amount of nitrogen taken down from the air in this manner. After long dry or smoky periods the amount was found to be increased. The widest variations were found in nitrogen as free ammonia; the most constant nitrogen fraction was that measured as albuminoid ammonia. Rain was obsserved to be richer in all nitrogen compounds than snow. It is suggested that this is due to the greater solvent action of the rain and is not due to any lack of combined nitrogen in the air during winter. The snow, acting as a filter for small particles in the air, was found to increase the percentage of albuminoid ammonia from 14% of the total in rain to 20% of the total nitrogen found in snow. These authors estimate from their data that the value of the nitrogen supplied to the soil in this manner annually would amount roughly to $1.30 per acre.

The subject of the natural gas supplies of Ontario came up at the session of the Legislature just closed. The Hon. G. Howard Ferguson said that the orders of the Ontario Railway and Municipal Board, giving domestic consumers the first call could not be regarded as a permanent solution of the trouble. The Government proposed to appoint an expert to study the situation from every angle, advise the Government as to what amendments could be made to meet conditions, and gradually, without radically interfering with industrial conditions, give manufacturers an opportunity to change their equipment to use some other fuel or power.

Spirit Production With Reference to the Future of Industrial Alcohol

By Dr. E. B. Shuttleworth

ARTICLE II.

Manufacture of Alcoholic Compounds in Bond

The creation of Bonded Factories was a direct outgrowth of the imposition of increased Excise duty on spirit. Prior to 1846 there was in the Canadas no direct tax on the product of the many distilleries then in operation, the only impost being an annual charge of one shilling and sixpence per gallon, Halifax currency, on the capacity of the still. At the date mentioned it was considered that the levy should be proportionate to the output, and a direct tax of two pence per proof gallon was put on the spirit manufactured. This was diminished, in 1849, to one penny, currency, per wine gallon, for any strength under proof, but, if above that degree, the charge was proportionate thereto.

Occasional increases were made, until 1864, when the tax was fixed at thirty cents per wine gallon proof. Approaching Confederation indicated a change in legislation, and a very probable rise in duty, with the undoubted effect of injury, and perhaps entire ruin to the progress attained in 1865, and the following years, in the manufacture of chemicals with an alcoholic base, or of preparations in which it acts the indispensable part of a solvent.

The efforts of those interested were successful in convincing the fathers at Ottawa that this new line of industry, then being vigorously pushed, was worthy of encouragement, and legislation was granted which provided for the establishment of Bonded Factories in which duty-free spirit could be transformed into non-potable compounds, under Government supervision, while a moderate tax, generally about 15 per cent., was imposed on the cost of the materials used in the manufacture of the resulting article, the import duty, if any, being remitted. This was quite a concession, more especially as the duty on spirit was doubled, and then stood at 60 cents per wine gallon, proof; equivalent to 72 cents on the imperial gallon officially recognized since 1875.

Several Bonded Factories were at once started and the list of permitted manufactures was very liberally extended to over one hundred articles. The latitude given was, indeed, too great so that compounds were approved which admitted some of direct potability. Abuse resulted, and in the end, led to the cancellation of the entire list, and the re-admission of a few, of which vinegar was the chief. This state of things continued for some twenty-three years when, in 1892, an order-in-council was passed approving of the use of alcohol under specified regulations, and at a reduced rate of duty, for the manufacture of perfumes. This privilege was enlarged and made more workable in 1914 by the Regulations (No. 406) then issued, and under which operations are now carried on.

In looking back on the intervening half century, since 1867, one can recall many ups and downs in the progress of bonded manufacture, and may derive some small satisfaction at the result. He can, at least, enjoy the gratification of knowing that Canada was among the first countries, on either side of the Atlantic, to recognize the possibilities of duty-free alcohol, and the injustice of taxing the industries of the country, and the prime necessities of the sick, at the same rate as imposed on the luxuries and indulgence of the well.

As a matter of fact a conclusion based on argument along these lines has been generally conceded by the Government, who have not questioned the soundness of the principle involved, nor the desirability of carrying it into practice—always provided that the sacred question of revenue remained untouched. This barrier has, hitherto, proved unsurmountable, but times have changed, as evidenced by the easy surrender of a large part of the income derivable from intoxicating liquor, and the probability

of the speedy relinquishment of the remainder. The annual loss of revenue from this might be roughly put at eight or nine millions—an enormous amount when compared with the sacrifice involved in the granting of duty-free industrial alcohol.

In resuming the subject of bonded manufactures, after this little digression which somehow forced itself forward, it may be said that, though progress has been very slow, a position has been gained ensuring permanent recognition in providing for the making of low priced necessaries—as vinegar—on which a regular spirit duty would not be tolerated by consumers; or of fulminate of mercury, in which the alcohol is completely transformed.

The regulations of 1914, previously referred to, proved a very decided encouragement to those lines of manufacture which they were intended to assist, and, as a result, the number of bonded factories has very materially increased. The annual Excise return for March 31st last shows the total licenses issued to have been 73 of which most were in operation. These include 18 for vinegar; 18 for perfumes; 13 for pharmaceutical preparations; 4 for soaps; 2 for extract; 1 for collodion; 1 for "compounding"; 2 for fulminate, and 4 for explosives other than fulminate. Besides these the list contains licenses for bonded factories which operate on wood alcohol (7); acetic acid (2) and malt extract (1). None of the latter call for ethyl alcohol, and are, therefore, beyond the scope of this enquiry.

It has hitherto been impossible to ascertain, either from published records, or direct inquiry, the precise quantities of alcohol used for the various purposes enumerated, except in regard to vinegar and fulminate, for which such data have always been available. Spirit used for other compounds has, apparently, not been separately recorded and estimates made as to the total quantity consumed have been more or less guesswork. This must remain so to some extent, but from a recent communication from the assistant Deputy Minister of Inland Revenue some additional information has been afforded and is expressed in the following extract from his letter in which he kindly promises to relieve the situation as soon as practicable.

> "I regret that the Department is not possessed of statistics in such form as to furnish you with details regarding the quantity of alcohol used for the manufacture of pharmaceutical preparations, chemicals, flavoring extracts, and other articles, which, no doubt, would reach substantial proportions. It is probable, however, that at the end of the present fiscal year steps will be taken to secure this additional information."

The following are the official figures as expressed in proof gallons:

Explosives	3,716,883.10
Fulminate	125,139.68
Vinegar	451,104.69
Perfumes	44,933.23
Transparent Soap	1,244.12
Tooth Paste	70.62
	4,339,376.44

To this must be added the unknown quantity used for pharmaceutical preparations, chemicals, extracts, and other articles, which, as the Assistant Deputy Minister states: "would reach substantial proportions." one might hazard a guess at 75,000 proof gallons; bringing the above total to 4,339,451.

The figures submitted for explosives and fulminate refer, of course, to war times, and for those of happier days, such as contemplated in this article, are subject to correction. For instance, prior to the war, explosives other than fulminate were not manufactured in Canada, and it may be presumed that the original condition will be restored, though it is possible that the existence of the requisite plant and skill may favor the production of some of the peace-time demand. However this cannot be counted on, and the consumption of spirit from that stated, must be reduced by 3,716,883 gallons. The amount for fulminate stated for last year must also be cut down to pre-war times' or from 125,139 to 73,932 gallons—the average for 1911 to 1914' inclusive. These war-time deductions amount to 3,768,090 gallons, leaving a difference of only about 646,000 gallons.

A rough attempt may now be made to estimate, on the data submitted, and with war influence eliminated, the normal consumption of spirit in bonded factories:

Vinegar	450,000
Fulminate	75,000
Perfumes	45,000
Soaps and Tooth Paste	1,400
Pharmaceutical Preparations, etc.,say	75,000
	646,400

The amount collectable on this quantity of spirit, at bonded factory rates, namely 75 cents per gallon, for vinegar, fulminate, perfumes and pharmaceutical preparations, and 15 cents for soaps and tooth paste, would be $505,960, which would thus represent the tax on necessary articles, none of which, except perfumes, can be classed as luxuries; a large proportion being only employed as medicine. To this direct charge there is to be added the burden borne by native industry, which, instead of receiving encouragement, is proportionately hindered in development.

III. Manufacture of Methylated Spirit

The idea of adding to alcohol some disagreeable compound which would render it practically unpotable, and still leave it fit for most industrial uses, was early recognized in Europe and in 1855 received official recognition in England where a compound was legalized consisting of duty-free spirit to which one-ninth of its volume of ordinary wood naphtha (incompletely rectified methyl alcohol) had been added. This was designated methylated spirit and by this confusing name was introduced into Canada, when the first Inland Revenue Act was passed, after Confederation, when it became one of the compounds which might be legally made in the newly-established Bonded Factories.

The words "denatured," or its Anglicized form, "denaturalized," were not then in use, but, by the beginning of the present century the former had crept in from the continent, but even now is only employed to a limited extent in England, or here. However ill-chosen or inexpressive these words may be they have to be recognized as designating not only alcohol which has been mixed with wood naphtha, but with any evil-tasting or smelling compound—as benzine, gasoline, and pyridine, or even one which is distasteful, as interfering with consistence—like resins, or entering into chemical combination with the spirit, as with sulphuric acid in the making of ether. Any of these denaturing agents may be used, but, for general purposes, wood naphtha still holds the preference.

The production of plain methylated spirit remained for many years in the hands of the bonded factories, which, in 1870, paid a duty of 12 cents per proof gallon on the spirit used. Ten years later this was increased to 15 cents, and in 1888 the Government took over the entire manufacture and sale of the two grades for which provision was made—No. 1, containing 25 per cent. of naphtha, of which the price was for the time fixed at $1.40 per standard gallon; and which could only be disposed of to those holding permits; and No. 2, presumably for burning, containing 50 per cent. of naphtha, disposable to any person and for any lawful purpose. This was priced at $1.60 per gallon. The sole right of selling naphtha to consumers was also reserved and the entire monopoly so continued until 1910 when the regulations took another form.

Under the order of June 22nd, of that year, two so-called "grades" of methylated spirit are provided—No. 1, which can only be sold to persons holding permits, such as varnish makers and "others engaged in the mechanical arts," and "No. 2"—

mainly designed for burning—which can be sold by anyone to anyone. Of No. 1 grade there are two qualities—"Standard," containing 25% of wood naphtha, the balance being strong alcohol; and "benzine," which has only 9% of wood alcohol. The deficiency of naphtha—which apparently means increased potability—being made up by the addition of 1% of benzine to 90% of alcohol. Of No. 2 grade there are also two kinds—"Standard" and "Colored"—both consist of 50% of wood naphtha, the balance being alcohol, but, in the case of the latter, a little methyl violet imparts a characteristic tinge.

It was designed that the spirit produced should be sold "practically at the cost of manufacture," which at the time was fixed at 65 cents per imperial gallon for No. 1 Standard, and 55 cents for benzine; and 75 and 60 cents, respectively, for No. 2 Standard and Colored, with a deduction of 2 cents per gallon, for all kinds, when shipped east of Quebec, or west of Toronto. Alcohol, of the inferior grade used for this purpose, cost the Government 25 cents to 30 cents per proof gallon, equal to 41½ to 49½ for spirit of 65 o.p.; and naphtha was purchased at 52 to 54 cents a standard gallon.

Last year the prices of alcohol and naphtha had, of course, advanced very considerably, the former costing from 40 to 55 cents per proof gallon while 87½ cents were paid for the latter. The different grades of methylated spirit realized corresponding rates, which, for the greater part varied from 83 cents to $1.10 per standard gallon. The official returns do not specify the grades manufactured or sold, but as benzine, or gasoline are not mentioned among the materials used, in 1915-16-17, it may be presumed that all the product made in those years was of Standard No. 1 Grade, that is, containing 25% of naphtha. Such could consequently be sold only to licensed users—varnish makers and such like. As 818 gallons of gasoline were, however, purchased in 1914 it is possible that a sufficient quantity of No. 2 grade was made at that time to supply the demand of the succeeding four years. However this may be it is evident that No. 2 is not a very popular grade though if the entire 818 gallons were consumed there would have been produced a total of about 81,000 gallons or at the rate of over 200,000 per annum. In the absence of sufficient data this question must remain unsettled, as also that of the total yearly output of the different grades during the period covered by official records.

Fortunately, however, there are annual statements of the number of proof gallons of spirit used, and though it is impossible to say how this was disposed of, the figures can be employed to show the development of the methylating industry. Its introduction took place in 1870, but the consumption of proof spirit did not exceed 100,000 gallons until 1910, and only amounted to 78,248 in 1909, equal to 47,421 gallons of 65 o.p.—a somewhat discouraging record of the progress made during nearly forty years.

The number of proof gallons of spirit used in 1910, and up to the present, may be usefully recorded:

1910	119,843
1911	156,726
1912	168,304
1913	212,007
1914	213,059
1915	155,807
1916	161,044
1917	252,546
	1,439,336
Average per year	179,917

The war does not appear to have exercised much influence on production, except, perhaps, during last year. Thus the consumption in 1911 and 1912 was practically that of 1915 and 1916, and 1913 that of 1914, but, taking the entire series, there is an increase of 110% in eight years, or about 14% per annum, which may be considered a fairly satisfactory but somewhat irregular growth. With such data the average yearly consumption may be assumed at that indicated, or say 180,000 proof gallons, equal to 109,090 gallons of 65 over proof.

IV. Duty-paid Alcohol Used for Industrial Purposes

A very considerable quantity of spirit is used for a variety of purposes by those manufacturers for whom Bonded Factory regulations fail to afford any provision; or whose operations are not of sufficient magnitude to justify the establishment of a concern of this kind; or who prefer to pay the full duty on spirit rather than submit to the restrictions implied by Government supervision.

Druggists consume much alcohol in the preparation of those spirituous compounds which are official in the British Pharmacopœia, as well as officinal compounds, as liniments, in which the spirit is as effectually denatured as if made under the strictest Excise formulæ. Besides these there is the supply of strong alcohol required for bathing, or such like purposes, as demanded and legally provided for by the prescriptions of registered medical practitioners. The supplies for hospitals must also be included, as well as that for colleges, professional laboratories, and educational institutions, usually classed as "for scientific purposes."

It is difficult, if not practically impossible, to ascertain with any degree of accuracy the quantity of spirit used to fulfil these demands. Some is shipped directly by distiller to consumer, but a larger quantity through wholesale druggists and dealers, without reference to the purpose for which such is to be applied.

Some two years since an attempt was made to ascertain from some of the above classes the quantity annually so disposed of, but the returns were incomplete, and indefinite, so that the resulting estimate was little better than guesswork, but in default of anything more reliable was set down at 203,416 proof gallons, and, making some allowance for increase, may be now taken in round numbers at say, 250,000 gallons.

The stage has now been reached when the data thus wearisomely presented may be focussed down to definite shape and dimensions, but, before making this venture, the writer would bespeak indulgence in regard to notes and recollections extending back for over half a century, which, as such, are liable to error though as carefully criticized and worked out as can be done by one who makes no claim to aptitude in statistical lines.

V. Annual Demand for Industrial Alcohol for Peace-time Purposes

Vinegar	450,000
Methylated Spirits	180,000
Fulminate	75,000
Chemical and Pharmaceutical Compounds	75,000
Perfumes	45,000
Soaps and Tooth Paste	1,400
	826,400
Various purposes (now paying full duty)	250,000
Total	1,076,400

If the above be adapted to present conditions, that is to war-time demands, as indicated by the returns for the year ending March 31, 1917, there must be added, in proof gallons:

For Explosives other than Fulminate	3,716,883
For Fulminate (excess over peace-time demands)	50,139
	3,767,022
For Industrial Alcohol, as above	1,076,400
	4,843,422

This means that the demand for industrial alcohol, this year, will likely be at least as great as the above figure and will amount to 88% of the annual average production of alcohol of 5 ante-bellum years, 1909-13, inclusive. This average equals 5,479,088, which is only 635,666 gallons in excess of the above demand of

4,843,422 and would be quickly swallowed up under a more active call for Canadian explosives.

It thus appears that, in any event, the distillers must this year furnish 88% of the normal yield, and, possibly over 100%—while under the most favorable, though at present impossible circumstances, the minimum of 20% must be produced to fulfil the imperative demands for industrial alcohol. It is therefore plain that distilleries must continue to exist, either to the present or a greater limit, or be decreased in number or output to one fifth.

In this connection the fact cannot be overlooked that there is already in storage in the bonded warehouses of distilleries a very large quantity of spirit. As previously shown this amounted, on March 31st last, to 16,953,808 proof gallons, which has probably been since reduced, but, in any case, reaches very large figures, equal possibly to a three year's distillery output, but of enormously greater value on account of the effect of ageing on the quality of the product which is now mostly in the form of whisky.

That the value of this amount of choice potable spirit is to become an absolutely dead loss on account of the Government withdrawal of means of transportation and disposal is quite unthinkable. Its destruction as a beverage, by conversion into strong alcohol, by rectification, would solve the question of ten or more years' supply of industrial alcohol, but, from a practical standpoint a loss of this kind would not commend itself to the consideration of any unbiased, level headed, business man.

Although to some extent irrelevant to the main subject of this paper the writer ventures a suggestion that this warehoused whisky be offered to the British Government, at fair rates, to substitute, or in part replace the spirit, generally rum, served out, at trying times, to men on the firing line, or in situations in which all possible help should be given. It is not a question of argument as to the right or wrong of the matter, but simply that the practice prevails in all armies and is recognized by qualified authorities as essential to the welfare of the soldier whose gratitude has been so frequently and fervently expressed.

It is hoped that the data embodied in this paper will prove adequate to supplying a basis for discussion and the necessary details for its development. Many questions present themselves amongst which may be mentioned the following: Extension of the uses of industrial alcohol, including employment of alcohol for power; changes in the composition of methylated spirits and in denaturing generally; additions to and revision of the list of compounds which can be made in bonded factories; abolition of excise tax on spirit used in bonded factories; production of alcohol for industrial purposes; possible sources of cheap alcohol; disposal of warehoused spirits, etc.

It is needless to say that each of the above demands separate and careful consideration and this paper will have served its purpose if the attention of those interested has been aroused so that a thorough discusssion of the various phases may follow.

Toronto, March 12, 1918.

Société de Chime Industrielle

Paris le 25 Février, 1918.

Monsieur le Directeur de CANADIAN CHEMICAL JOURNAL:

Nous avons l'honneur et le plaisir de vous annoncer la constitution en France, d'une "Societe de Chimie Industrielle."

Fondée pour établir une liaison permanente entre la Science et l'Industrie, cette association groupe déjà les notabilités des diverses régions de notre Pays. Son Conseil d'administration comprend les personnalités les plus éminentes de l'Industrie. Le Comité de rédaction de ses publications est composé des noms les plus marquants de la Science. C'est en quelque sorte l'alliance de toutes les forces vives de France décidées à agir en commun, pour:

1°. Contribuer à l'expansion de l'Industrie chimique dans tous ses domaines;

2°. Grouper tous les chefs d'industrie: Professeurs, Ingénieurs, Chimistes, Constructeurs, etc., qui y sont intéressés;

3°. Contribuer aux progrès de la Chimie Industrielle tant au point de vue économique qu'au point de vue scientifique.

Une Revue technique constituera l'organe officiel de notre groupement et servira de trait d'union entre tous nos membres. Destinée à les tenir au courant, non seulement des travaux de nos compatriotes, mais encore des nouvelles recherches scientifiques entreprises dans les différents Pays, elle s'attachera à élargir de plus en plus le domaine des inteventions pratiques de la Chimie.

Avant la guerre, nos deux nations ressentaient ensemble tout le poids des efforts de la Chimie allemande et de l'envahissement de ses porduits. Elles luttent en ce moment pour la même cause: la défense de l'humanité et l'émancipation du Monde. C'est un devoir pour elles, maintenant qu'elles se sont libérées de l'étrein te si lourde de penser à l'avenir et de le préparer.

Depuis de longues années et en particulier ces temps derniers, nos rapports nous ont appris à nous mieux connaitre et à nous apprécier davantage. Cet accord confiant et parfait qui préside aux relations cordiales que nos nations respectives entre tiennent doit être continué après la guerre, si nous voulons que la victoire porte ses fruits. Notre triomphe sur les champs de bataille doit s'accompagner d'une forte organization économique interalliée, afin de déjouer les nouveaux plans de domination commerciale et industrielle que viennent d'élaborer les empires centraux.

A l'heure ou dans tous les Pays de l'entente, les hommes soucieux d'un avenir heureux et fécond, songent à ces lendemains d'efforts communs et d'inébranlable amité, il est bon que les grandes associations multiplient entre les divers peuples alliés, les moyens de pénétration réciproque, les échanges de pensées, de sympathie et de vues pour l'avenir.

La diffusion des publications scientifiques & techniques peut aider, dans une large mesure, à affermir et à accroître les sentiments qui unissent nos deux patries. Nous la faciliterons, de notre côté, avec toute l'ardeur de nos aspirations.

Nous nous permettons de faire appel à votre sympathie et venons vous demander dans quelles conditions vous seriez décidés à titre de propagande, à nous envoyer, pour la bibliothèque très importante que nous constituons, les diverses publications susceptibles de nous intéresser, notamment:

"CANADIAN CHEMICAL JOURNAL"

Nous pourrions, peut-être, faire un échange de nos publications. Mais, comme notre Revue ne paraîtra qu'en Avril prochain, nous vous serions très reconnaissants de nous faire "don," pour notre bibliothèque, des numéros de l'année 1917.

Le Secrétaire-Général,

JEAN GERARD.

Lapsed Patents

(Reported by Hanbury A. Budden, Research Bureau, Montreal)

The following Canadian patents lapsed during the month of February for non-payment of fees:

No. 138,249.—Pigment manufacture (Belgium). Treating pigment with soluble catalyser, heating and washing.

No. 138,351.—Manufacture of Lamp Filaments, "Jahoda." (Austria). Filaments formed of oxides and binder, carbonized and reduced in presence of hydrogen and carbon.

No. 138,573.—Cork manufacture, "Pink." (Germany). Dipping corks in celluloid dissolved in collodium, drying, dipping in bath of sulphuric acid.

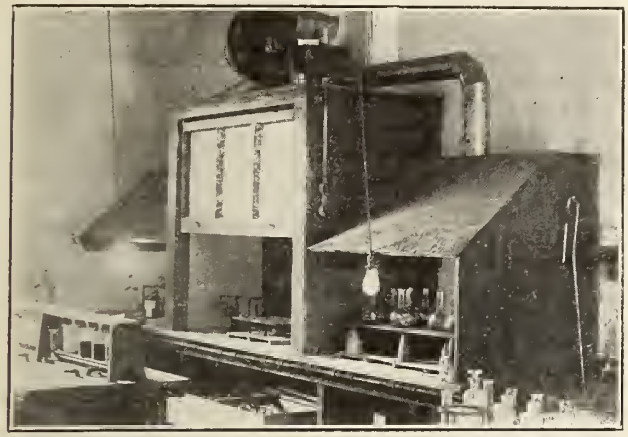
No. 138,796. Water purifier, "Brands," (Germany). Passing over aluminium while exposed to light.

No. 138,846. India Rubber Manufacture, "Reynaud," (France). Rubber caused to absorb spirit of turpentine adding chlorine and treating with water.

No. 138,858.—Process of obtaining Potash Salts from Feldspar, "Thompson," (U.S.). Pulverizing, mixing with sodium acid sulphate and sodium chloride heating and leaching.

Steel Laboratory of J. T. Donald & Company

In the early part of the war the firm of J. T. Donald & Company, Consulting Chemists, 318 Lagauchetiere Street, Montreal, was asked by the Imperial Ministry of Munitions to undertake a large quantity of referee work in connection with the steel output for high explosives shells. It was the desire of the Imperial Ministry to have this work done as economically and



Draft Cupboards for solution of samples for phosphorus determination and manganese oxidation. In lower centre are cooling tanks for manganese determination.

rapidly as possible without in any way interfering with accuracy. The laboratory herein described is the outcome of this work and we believe represents a maximum efficiency combined with the greatest possible accuracy.

General Description

The laboratory occupies two floors of the building. The ground floor is divided roughly into three parts: (a) A room for carbon determinations, (b) a room for silicon determinations, (c) store room.

The next floor is divided into a balance room and general laboratory. The general laboratory handles sulphur, phosphorus and manganese determinations and the other determinations run occasionally on steel, such as aluminum, nickel, chromium, copper, titanium, etc.

The draft cupboards in the silicon room and the general laboratory are operated by an exhausting fan and the laboratory kept practically clear of fumes.

Details

CARBONS.—These are all determined by the direct combustion method. A Hoskins, Type F.A. 301, 110 volt, 10 Amp. furnace

Silicon Cupboard, carrying 20 determinations concurrently, Electric Muffle furnace for S_1O_2 Ignitions.

is used in conjunction with an absorption apparatus largely evolved by the staff. In connection with these furnaces the firm's mechanic winds all their heating units, using nichrome wire on alundum tubing. When a unit burns out the alundum cement and wire are stripped from the tube, and the tube rewound with new wire and covered with cement. Before introduction of the wound unit into the furnace, the heating element is placed in a separate circuit for about fifteen minutes. This serves the double purpose of drying the cement and of testing the winding The absorption apparatus was gradually evolved as the shortage from the regular forms of glass apparatus made itself felt. The apparatus, as at present used, is made up of Johnston tubes, mineral jars, 1″×6″, rubber corks and glass and rubber tubing where necessary. The rubber corks must be tight, and the rubber tubing must be used only glass to glass joints. The final absorption is made in Johnston tubes using 40% Pot. Hydroxide.

The oxygen is supplied from a cylinder of compressed gas feeding into aspirating jars. A small stop cock is put before the final Johnston Absorption tube and so regulated that the rate of flow of the oxygen through the absorption tube is kept within safe limits. It has been found from long experience that a too rapid flow causes a low moisture content with consequent low results. When a furnace is at the proper temperature the steel is placed in the boat, put in position in the tube and the oxygen supply turned on full, the pressure being regulated by the height of the aspirating bottle, which is never placed so that the pressure is too great for the connections in the apparatus.

As the combustion of the steel takes place the oxygen passes into the combustion tube very rapidly and the steel consequently burns very quickly. When the combustion is complete the rate of flow of oxygen is automatically controlled by the stop cock, placed in the end of the absorption tube and the oxygen passes through at a regular rate for fifteen minutes after the completion of combustion.

Centre—Phosphorus filtration apparatus, featuring the circular filtration stands.
Left—Rack for sulphur determination.

Six furnaces are operated continuously and two furnaces kept in reserve. One man operates each set of three furnaces and puts through about sixty determinations in an eight hour day making all his own weighings. Three balances are employed in connection with carbon determinations.

SILICON.—The silicon determinations are made by the sulphuric acid method, using sulphuric acid alone for solution and evaporation to fumes. The residue is then taken up, filtered, ignited and weighed. It is found that this sulphuric acid method gives a solution which filters very much more rapidly than that obtained by using nitro-sulphuric, as the iron salts are in the ferrous state.

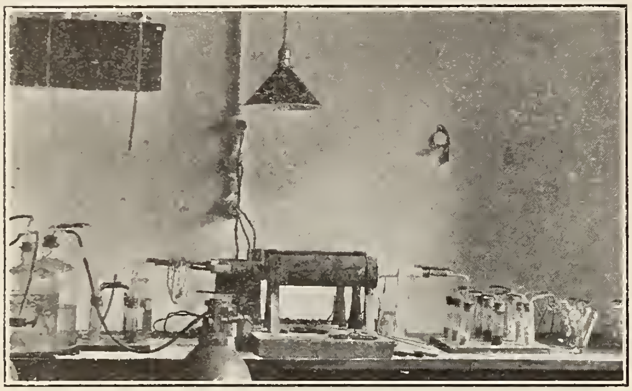
SULPHUR.—The sulphur determinations are run by the evolution method and absorption in ammoniacal cadmium chloride with subsequent titration with iodine, using starch as an indicator. The titration of the cadmium sulphide precipitate is made directly in the solution after acidifying with hydro-chloric acid. This is found to give very satisfactory results, providing conditions are kept standard.

MANGANESE.—Several methods have been tried in connection with this determination and the lead peroxide method has been adopted as being the most generally satisfactory. Volhard's method involving a separation with zinc oxide emulsion was

also at one time used, and is very satisfactory, removing any danger of incorrect results due to the presence of chromium, etc. It is, however, very slow comparatively.

Every satisfaction has been given by the lead peroxide method. It combines rapidity with accuracy. One point in connection with this method, however, which has to be watched is the danger of the presence of chromium which gives high results even when present in traces.

PHOSPHORUS.—The method used here is a modification of the usual phospho-molybdate precipitation followed by the titration of the yellow precipitate with standard alkali. The modification



Carbon combustion train.

in use in this laboratory consists of titrating the yellow precipitate directly with dilute caustic soda after adding about 200 c.c. of boiling water. Phenolphthalein is used as an indicator. Several advantages are found in this modification. First only one standard solution is required as against two when the usual back titration method with nitric acid is used. Secondly, the boiling water breaks up any carbonates which might be present and which would give erratic results. The method has been thoroughly tried out and no danger of low results exists, providing boiling water is used assuring the complete solution of the yellow precipitate.

Analysis of the Chemist—Qualitative and Quantitative

By the Youth

OTTAWA, the Ides of March.

A chemist is a thin film of matter, one atom deep, which clings to industry like a scum for support. He travels in more disguises than any Sherlock ever dreamed of and gathers infinitely less booty along the way. His temerity is such that he would think twice before holding up a fly—for more salary. Every chemist is the best chemist that ever carried rotten results to four places of decimals. His sense of cooperation with any other chemist is less than that of an exploding powder plant. A "professional chemist" is a misnomer. There is no such profession. Ask the first real professional man you meet and he will tell you.

The only things in a chemist's world are other things. If you introduced him to a man getting $200 a month he would probably blush, lift his hat, and bow. He blows his own horn with the same sense of probable effect as a man learning to play a clarionet. He feels in his soul that it is just barely possible that the public needs education to appreciate him so he spends his spare time telling his closest friend—the stenographer—what a "basic industry" is. For him all the real salaries are in Peru.

Being a true descendant of one Dalton he still imagines himsel to be a "perfectly elastic sphere," without pockets, or hooks of attachment of any kind visible or invisible. Having less general intelligence than the average potato he refuses to sprout. Some abnormal specimens have been known to sprout, but it never ran to two generations and is by no means contagious. He jumps from one "job" to any other with the alacrity of a cat and with that same "green field far away" look in his eye. The words, "position," "manager," "executive," were left out of his dictionary.

Having attended lectures and mopped up experience on all subjects at great price—except that variety given gratis by barbers and street car conductors' unions—he feels more than confident that he can pass the buck up to the whole world all alone. Should he by any chance fail to sustain the 20% dividend of his firm he has a most peculiar sense of dying game in the attempt. He has the same cause as the early Christians for desiring wealth in the future world.

His ancestors are the most notorious ancestors on record. He is in direct line with all the thugs of the Middle Ages. With such a handicap it is no wonder that the leading grocers refuse him the chance of leaving his card, even to-day, while the doctors, lawyers, and dentists, turn up their noses in utter scorn, crying "Unclean!"

Only such things as plagues and epoch making wars have a ghost of a chance of blowing the debris and junk off his head. Sometimes by reading carefully between the lines of his own trade journals he thinks he sees emancipation for him. Being thus encouraged by this cosmopolitan view he again approaches the stenographer, whom he finds has a date on with the lawyer—a future premier. So after all he guesses the war might not stop if he slept in in the morning. They would probably go after each other with stones anyway. Cogitating thusly he deftly lowers the trap door over his head once again. Relatively speaking, "going down."

RECENT INCORPORATIONS

Toronto.—Falconbridge Lands, Limited. G. Grant, M. Macdonald, E. Smily, B. Williams. solicitors. Capital $10,000. To develop mines, mining lands and deposits, and to treat ores, metals and minerals.

Montreal.—Phillips Steel & Wire Co., Ltd. M. Alexander, A. H. Elder, Felix W. Hackett, solicitors. Capital $100,000. To mine, smelt and manufacture steel, iron and wire.

Montreal.—Leonard Tractor Company of Canada, Limited. W. W. Skinner, W. G. Pugsley, G. G. Hyde. Capital $1,000,000.

Montreal.—Williams & Wilson, Limited. W. A. Wilson and F. C. Wilson. Capital $500,000. To do a general business in iron, steel and metals.

Montreal.—Tolland Manufacturing Company, Ltd. Waldo W. Skinner, K.C. solicitor. Capital $50,000. To manufacture and deal in iron, steel and all other metals and minerals.

Montreal.—Mannesmann Tube Company, Limited. Victor Geoffrion, K.C., solicitor. Capital $100,000. To act as manufacturers' agents in dealing in all kinds of steel, iron and metal tubes and fittings.

Vancouver.—British-American Shipbuilding & Engineering Co., Ltd. Capital $1,000,000.

Winnipeg.—The Western Paint Company. J. E. Guertin, L. P. Guertin and L. Guertin. Capital $200,000.

Winnipeg.—R. A. Lister & Company (Canada) Limited. Sir Robert Ashton Lister, of Dursley, Gloucester, England. Capital $1,000,000. To carry on in Canada an iron and brass foundry business, and to deal in metal and mineral goods generally.

Union Chrome Company, Limited. Irving L. Wiltsie, New York City. Capital $500,000. To carry on in Canada the business of mining, smelting and dealing in chrome, copper, nickel, and other ores, minerals and metals.

Canadian Mining Institute

The annual meeting of the Canadian Mining Institute was held at the Windsor Hotel, Montreal, on the 6th, 7th and 8th March. The attendance was up to the average of recent years.

The president, Mr. A. A. Cole, in opening the convention, reminded his audience that the Canadian Mining Institute had passed its twentieth year. Referring to the Great War he said that members of the Institute had volunteered in large numbers and had made an enviable record at the front.

Much of their work in the war was, of course, of a destructive nature, but those at home could undertake a great constructive task, for it was the opinion of Lloyd George that there must follow a world shortage of raw materials which would increase the longer the war lasted.

"Canada," said Mr. Cole, ""with her vast resources of raw materials will in this respect be one of nature's most favored nations. The appeal for preparedness is most urgently applicable to the members of the Canadian Mining Institute, the representatives of the great basic industry that must be responsible for the making of many of these raw materials available for our industries and commerce."

To do this Canada must become more self-reliant, politically and financially, as well as economically. The success of the Victory Loan last year was a long step towards financial independence, seeing to what an extent Canada had previously been a borrowing nation. Our unfavorable trade balance with the Mother Country has been changed to a rapidly increasing favorable trade balance which in 1917 passed $400,000,000. This balance is now being used to wipe out some of our foreign borrowings or to transfer them to this country. As a result of this movement our large outside interest payments are rapidly being reduced and the interest paid out at home is correspondingly increased.

Our general industrial and commercial developments are so clearly related to and dependent on the mining, metallurgical and chemical industries that it is next to impossible to draw a hard and fast line between them so it is better to consider them together.

In 1915, the mining, smelting and related industries of Canada employed 104,425 men and yielded products of a value of $265,046,000. In addition, and directly following this production, 50,393 men were employed in further manufacturing these products, giving to them an added value of $103,912,000. Thus of a total of 2,723,000 wage earners in Canada, one-ninth are employed in the mining and dependent industries. As a further evidence of the importance of the mineral industry it may be noted that in 1915 the tonnage supplied to the railways of Canada by the different industries was:

Products of Mines	37.89%
Products of Agriculture	18.79
Products of Forests	16.03
Manufactures	14.76

The relative importance of the mining industry in the development of the country has been great in the past, but it must be of still greater importance if we are to progress. We are to a large extent responsible for the production of the raw materials essential in our metal industries and much of our general manufacturing. Fortunately for us, nature has bountifully endowed our country with most valued natural resources. A heavy responsibility thus rests on us and it behooves us to make a rigorous self-examination to find how we are making use of the talents delivered into our care.

First of all we must have an inventory of our natural resources and find out where we are deficient and then develop our known resources. Certain branches of the mineral industry are well developed and are expanding; others are in their infancy, while in other lines we are far from being self-supporting. The demands of the war have stimulated certain branches of our metal industry to an extent undreamed of a few years ago. Iron and steel are most noteworthy examples This could not be otherwise when we consider that through the Imperial Munitions Board orders have been placed in Canada aggregating $1,100,000,000 for Munitions, and on these orders the sum of $875,000,000 has already been expended. Among other things Canada has machined 53,000,000 shells, and munitions are now being made on a large scale for the United States. Between five and six hundred plants in the country are employing from 250,000 to 300,000 workers including as many as 35,000 women at one time. How can we arrange that when the war orders cease the industry will not fall back. In the expansion of this industry for war work a large number of electric furnaces for the production of shell steel have been constructed. This steel is largely made from steel turnings produced in the manufacture of shells, but Dr. Alfred Stansfield thinks that before long we shall be using the electric furnace, as in Sweden, for the production of pig iron and steel from our native ores, and shall thus add materially to the value of the iron and steel trade, which is always a basic one in any industrial country.

Among the metals now for the first time being produced in the refined form in Canada may be mentioned copper, zinc and magnesium. Works near Montreal and Toronto have been established or enlarged for the working up of brass and copper so that in future the Canadian manufacturers should be better able to obtain their requirements in this country and less dependent on importing their supplies from abroad. The case of magnesium is not so rosy but a possible outlet for this metal is in light alloys suitable for use in aeroplane construction. Turning to the precious metals, the silver producers seem well pleased with the present status of the metal and are satisfied for the future to let the law of supply and demand take its course, the general idea being that the world shortage is bound to stiffen up the price. With gold, however, the circumstances are altogether different. Gold has been adopted as the standard of value by all the leading nations of the world. Being the standard of exchange its nominal value remains stationary, but if we judge it by its purchasing value of such commodities as wheat we find that in the last five years it has depreciated about fifty per cent. This has started an agitation among some people for the discontinuance of gold mining, while this condition holds, and others go farther and contend that gold is a non-essential and that gold mining should therefore be discontinued for the duration of the war. I am most emphatically opposed to this view. At the present time we are fortunate in having favorable trade balances with both Great Britain and the United States, but this is the first time in our history that such has been our happy lot. We need a surplus of gold so as to be able to liquidate any adverse trade balance and we also need more gold than we have at present in order to increase our reserve somewhat in the proportion in which we are increasing our national indebtedness. This gold reserve forms the foundation on which we build the structure of our national credit.

In the consideration of deficiencies among our natural resources the greatest is assuredly our lack of fuel in Central Canada. Our coal deposits of the East and West represent over 17 per cent. of the world's reserve of coal, but our production is comparatively small and we import more than we produce. We are entirely dependent on the United States for these imports and if for any reason this source of supply should be cut off or even restricted the results in Central Canada would be proportionately disastrous. The further development of Hydro-Electric Power will replace a large amount of coal now used for the generation of power. To take the place, in part at least, of the imported coal now used for heating purposes, we have a possible solution in the briquetting or other preparation of the low grade fuels of Manitoba, Saskatchewan and Alberta, while in the East we have millions of tons of excellent peat located in bogs adjacent to our principal industrial centres awaiting commercial development.

In carrying out any plans looking towards the greater independence and self-reliance of our metal industries, our principal work must be carried on through our governmental departments, either Federal or Provincial. The Canadian Mining Institute has recently presented to the Prime Minister a memorandum containing certain suggestions along these lines. One of the suggestions was the immediate consolidation and strengthening of the Department of Mines. By doing so, much of the past and present dissipation of funds and energy can be avoided through non-duplication of effort by different branches of the Civil Service and Commissions.

If the Department of Mines were strengthened and extended to a degree commensurate with the importance of the mineral industry in Canada I am firmly convinced that a Minister of Mines charged solely with the work of this Department and giving his undivided attention to it, would find that he had one of the most important portfolios of the Cabinet, and worthy of the best work of the biggest man mentally that the Government of Canada can produce.

Mr. Cole then cited the case of the Government advertisement for a chemist and a legal officer (referred to in our last issue) as a proof of the need of improving the financial status of technical men in the service.

That this point has not been appreciated before now is all the more remarkable when we know that the demand from our manufacturers for trained chemists and metallurgists is unprecedented. The work of the Department of Mines could be extended so that not only would it deal with the winning and manufacture of our minerals and mineral products, but could closely study markets in close co-operation with the Department of Trade and Commerce. Closer co-operation between the Department of Mines and the Provincial Bureau of Mines should also be encouraged.

The business success of Germany in the past has been due in large measure to the Cartel system, which is a combination fostered by the Government to help small and large producers in the marketing of their products and also in the purchasing of supplies. If our mineral products were handled in some such co-operative manner great savings would result, and we would have some chance of thwarting the designs of the German Metal Trust which when war broke out all but controlled the metal markets of the world. Co-operation among producers with the sanction and support of the Government should be a watchword within the industry.

There is a movement on the part of a few engineers to try to combine within a single society all engineers, no matter to what branch of engineering they may belong. This is a decidedly retrograde movement and is foredoomed to failure, as it is working directly contrary to the natural tendency of our national progress towards more independent development and self-reliance. The different branches of engineering have become so specialized that as soon as a branch become strong enough it is bound to form an independent self-supporting society. As a pioneer along these lines we welcome such development, feeling that in this way the best results can be obtained. During times of stress when concerted action is necessary co-operation is easily obtained between the executives of the different engineering societies.

Mr. Cole concluded: "Black as the whole world's future must appear to many as viewed through the intervening bloodshed, pestilence and famine, our faith never wavers in the justice of our cause and our belief never varies that Canada is one of the best countries in the world in which to live and work. If we, as the representatives of one of the great basic industries of the country, will do our duty faithfully and fearlessly to the best of our ability we can calmly face the future and leave our destiny to the All-Wise Providence, who has dealt so bountifully with our beloved Canada."

The memorial referred to in the president's address was one adopted by the Council of the Institute and presented to Sir Robert Borden, as Prime Minister. The memorial set forth the opinion that the mining industry was the greatest source of wealth and therefore of increase of public revenue, and that the exploitation of the mineral resources should have the assistance of the Government; that the medium through which this could be done was the Department of Mines; but that effort and money had been dissipated in the past through the duplication of work "by different branches of the Civil Service and Commissions." In 1907 the Mines Branch was separated from the Geological Survey, the former being placed under the direction of a Minister who was head of another department. It was apparently intended that the Mines Branch should take over all that was possible to assign to it within the terms of the act creating it, as the forest resources were mentioned as coming within its scope. The memorial stated:

"The reason why it is believed that the division of the functions of the Department of Mines, as by the Statute provided, is erroneous, is that in practice it has led to overlapping, to divided authority, and to friction arising out of sectional jealousies. Probably the reason for these difficulties has been, as much as for any other, that the Minister has never been charged with the sole purpose of attending to the mining industry, has always had other manifold duties to perform, and has never been long enough in office to enable a continuity of policy, such as should have existed in respect to so important a subject."

In the past six years no less than eight Ministers or acting Ministers had had charge of the Mines Branch.

The memorial then pointed to the Commission of Conservation, created in 1909, as having made the first great inroad on the work of the Mines Branch, and this was followed by the Natural Resources Division of the Department of the Interior, and later on by the Munitions Resources Commission, whose function is to advise the Imperial Munitions Board on the available minerals that might be used for war purposes. It was the opinion of the memorialists that the duties of the last named commission could have been well performed by the Department of Mines, aided by the Canadian Mining Institute and the Provincial Departments of Mines. This duplication of work led to waste, extravagance and the partial paralysis of the department primarily affected.

The national importance of mining was shown by the fact that of the 2,723,000 wage earners of Canada one ninth are in the mining and dependent industries, and that the mines supplied over 37 per cent. of the tonnage of the railways.

The circumstance that Canada, while producing more asbestos than any other country, still exported most of this fibre in a crude state; was pointed out as an illustration of the possibilities of new industries if there was a more vigorous department of mines with less duplication.

The memorial proceeded: "To encourage prospecting on Crown lands, under Federal control, the provisions governing the securing of title should be of a satisfactory and permanent character. The Regulations in respect of tenure to mining lands have hitherto been established by Order-in-Council, and being subject to amendment under conditions that do not permit of the public being fully advised of such change, are detrimental because of their instability. The Canadian Mining Institute has urged repeatedly the wisdom of withdrawing the Orders-in-Council relating to mining, and substituting therefor laws in the form of a Statute. In 1910 the Minister of Mines charged the Institute with the preparation of such a Statute. It produced what, it is believed, embodies the desires of those engaged in mining in Canada. The result was printed and circulated by the Government, but has never been presented to the House. There were two sources of objection to its presentation—one the Department of the Interior, from which it would remove the disposition of mining lands, and the other, the member for the

Yukon, who disagreed with that portion of the Bill applicable to placer mining in the Yukon. In conclusion the memorialists urged the enactment of the Mines Bill.

At a later stage of the convention, Mr. James White, assistant to the chairman of the Commission of Conservation, appeared and made an emphatic protest against the allegations and inferences of the Council. Mr. White said that these covert attacks on the Commission had been made by innuendo for years past, and he protested that those who were making use of the Council of this Institute should come out in the open, when their animus could be exposed. He denied that the work of the Department of Mines had been encroached upon by the Commission of Conservation, or that the department could never get enough funds to carry on its work. He had gone over the records himself and found that from 1910 to 1916 an aggregate of $770,000 of the sums annually voted for the Department of Mines had been turned back to the treasury as unexpended, yet this document declared that the department could not obtain funds. On the other hand the field work of the Commission, so far as it related to mines and minerals had not aggregated a thousand dollars a year. Moreover some of the most valuable reports published by the Commission had been the work of men of distinction in public life who had not charged a cent for their time and service. As an example of the work done by the Commission Mr. White said it defeated the application for damming the St. Lawrence at the Long Soo by an alien corporation, and also an application under the guise of a canal charter which if granted would have alienated to a corporation all the water powers of the Pigeon, Rainy, Winnipeg and Saskatchewan Rivers, between Lake Superior and the Rocky Mountains. A flood of other water power legislation was withdrawn after that. Last July notice was given of an application that was to have been made for power to dam the St. Lawrence at Coteau, which would have handed over to private control one of the most valuable water powers in North America. Two days before the application was to be made the Commission of Conservation handed in to the Minister of Public Works, a protest and the application was never pressed. The interests had laughed at the Commission; but now they were attacking it because they found the Commission was standing on guard over the resources of the Dominion.

Mr. White concluded by moving the following resolution:

"That the Canadian Mining Institute regrets that the memorandum respecting the mining industry submitted to Sir Robert Borden, February 8, 1918, contains serious errors of statement respecting the Commission of Conservation, particuarly: (1) The statement that the Department of Mines "could never obtain the necessary funds" to carry on investigations; (2) That Act 3-4, George V., Chap. 12, Sec. 1, empowered the Commission of Conservation to appoint permanent officers and employees; (3) The allusion to the reports listed in the "List of Publications published by Commission of Conservation, which allusion is so worded as to indicate that said Commission had been carrying on extensive investigations respecting mines and minerals, and that the secretary be instructed to send a copy of this resolution to the Right Hon. Sir Robert Borden."

The motion was seconded, but the chairman declared it to be out of order.

Mr. White maintained that this was a question of facts and of right and wrong and he appealed to have the wrong set right, and that the judgment of the convention should be taken on the action and methods of the Council.

The chairman said he could not alter his ruling, which he rendered on the ground that such a matter should go before the incoming council and not be decided by the convention. He suggested that the whole matter should be referred to the new Council for investigation and report and on motion the chairman's ruling was sustained.

New Section

On motion of Mr. J. A. Irwin, seconded by Mr. Morrow, a resolution was presented to establish a Canadian iron and steel section of the Institute, leaving the relations with the Canadian Mining Institute an open question.

In amendment Messrs. MacDougall and Evans moved that the iron and steel organization be formed as a Section of the Institute. After full discussion the amendment was adopted and an organizing committee of the new Section was formed as follows:

Messrs. Robert Hobson, Hamilton; Col. Thomas Cantley, Mark Workman, W. C. Franz, Dr. Alfred Stansfield, W. J. Jannsen, H. H. Jacquays, J. A. Irwin, C. F. Bristol, Esmond Peck, G. H. Duggan and P. L. Miller, of Montreal; F. H. Macdougal, Sydney, N.S.; F. Crockard, New Glasgow, N.S.; J. J. Hartley, Kingston; George W. Watts and Wm. Inglis, Toronto; J. G. Morrow, C. W. Sherman and W. M. Curry, Hamilton; Col. David Carnegie, Ottawa; Capt. David Kyle, Sault Ste. Marie; T. R. Deacon, Winnipeg; Fleet Robertson, Vancouver; and George McKenzie.

The following were among the papers on the programme:

"Some Problems in the Re-Construction of Industry," by Col. David Carnegie.

"The Whitley Scheme," by Mr. C. V. Corless.

"The Vocational Re-Education of Disabled Soldiers from the Mining Industry,"' by Mr. F. H. Sexton.

"The Personal Problem of the Technical Man in Wartime," by Mr. E. B. Kirby.

"Secondary Enrichment in Relation to the Water Level," by Mr. L. C. Graton.

"The Rio Tinto Mines, Spain," an informal illustrated lecture by Mr. W. A. Carlyle.

"Fuels of Canada and the Work at the Fuel Testing Station at Ottawa," by Mr. B. F. Haanel.

"The Stimulation of Coal Production in Canada," by Mr. J. F. Kellock Brown.

"Waste in Coal Mining," by Mr. W. J. Dick.

"The Anthracite Situation in the United States," by Mr. Eli T. Conner.

"Possible Contributions of the Cottrell Process to the Fuel Problem of Canada," by Dr. J. G. Davison, of Sault Ste. Marie.

"The Possibilities of the Extension of By Product Coal Production in Canada," by Mr. F. E. Lucas.

"The Utilization of Canadian Peat Resources," by Mr. E. B. Moore.

"Fuel Economics," by Mr. D. B. Dowling.

"Groch System of Centrifugal Flotation," by Messrs. W. E. Simpson and Frank Groch.

"Flotation Work at the Highland Valley Mines, B.C.," by Mr. Frederic Keffer.

"Canadian Wood Oils for Ore Flotation," by Prof. J. W. Bell and Mr. J. M. Scott.

"Comparison of Points in Flotation, the Moore Filter, and Cyaniding Cases," by Mr. R. C. Canby.

"Graphite in Quebec and Alabama—A Comparison," by Mr. H. P. H. Brumell.

"The Role of Electrical Precipitation in Metallurgy and the Recovery of By-Products," by Mr. Walter A. Schmidt.

"The Production and Uses of Stellite," by Mr. S. B. Wright.

"The Manufacture of Nickel-Copper-Alloy-Steel (Nicu-Steel)," by Mr. G. M. Colvocoresses, read by Mr. H. A. Morin.

"Canadian Ship Building," by Col. Thos. Cantley.

"Ferro-Molybdenum," by Mr. J. W. Evans.

"The Manufacture of Ferro-Alloys in Canada," by Dr. Alfred Stansfield and Mr. Geo. C. Mackenzie.

"The Manufacture of Crucible Pots for Steel Melting," by Mr. C. F. Bristol, of the Armstrong-Whitworth of Canada.

"The Quebec Bridge"—an illustrated lecture by Col. C. N. Monsarrat.

"Occurrences of Silica in Eastern Canada and Its Economic Uses," by L. H. Cole.

"Resume of Geological Field Investigations during 1917," by members of the staff of the Geological Survey of Canada.

"Genesis of the Sudbury Nickel Ores as Indicated by Recent Explorations," by Messrs. Hugh M. Roberts and Robt. Davis Longyear.

"The Geologist and the Development of Our Oil Fields," by Mr. M. Y. Williams.

"Molybdenite in the Ottawa Valley," by Mr. Morley E. Wilson.

"Hints on Prospecting for a Few Canadian Metals," by Mr. Wyatt Malcolm.

"Mining in Northern Manitoba," by Mr. E. L. Bruce.

"Safety Measure at the Thetford Asbestos Mines," by Mr. Thos. Loyd.

"A Re-Study of the Cobalt Area," by Mr. Alfred R. Whitman.

"The Mesozoic Period of Mineralization in British Columbia," by Mr. Stuart J. Schofield.

Some of these papers are referred to elsewhere.

Labor, Capital and Industry

The paper by Col. David Carnegie, ordnance adviser of the Imperial Munitions Board, dealt with the problems of industry, labor and capital after war. The consumers, the sellers the manufacturers and the workers were involved. Some of the obstacles to be overcome were the indifference of people to revolutionary changes in industry, the tendency to unfair competition and the selfishness responsible for this kind of competition. He suggested the formation of two distinct organizations for each industry, one to secure trade and one to produce goods. There should be national and district trade boards and district production boards, the trade boards to be formed of manufacturers and buyers, and the production boards to be formed of manufacturers and employes, the government to have the benefit of advice from the chairman and vice-chairman of each board. By these means he thought that unfair competition would be succeeded by a more righteous "competitive co-operation," as self-love in industry was opposed to Christian ethics. He instanced the fierce competition generated by the German Kartel system as proof of this. With a righteous international control of production there would be no disastrous over-production and waste of labor.

On a kindred topic was the paper by Mr. C. V. Corless on the "Whitley Scheme" for the adjustment of the conflict between capital and labor. Mr. Whitley was head of the commission appointed in Great Britain last year on the problem, and the opinion of most of the trade unions was overwhelmingly in favor of the report, which recommended joint councils of masters and men, with equal representation, for averting disputes. The Minister of Labor adopted the report and announced the decision of the government as follows:

(1) That Joint Standing Industrial Councils should be established in all the well-organized industries with as little delay as possible.

(2) That these Councils would be considered by the Government as "official standing Consultative Committees on all future questions affecting the industries which they represent" and would be the "normal channel through which the opinion and experience of an industry will be sought on all questions with which the industry is concerned," and

(3) That the Councils are to be "independent bodies electing their own officers and free to determine their own functions and procedure with reference to the peculiar needs of each trade." These autonomous councils will thus "make possible a larger degree of self-government in industry than exists to-day."

These Joint Standing Industrial Councils, of national scope for each well-organised trade, will be supplemented by District Councils and these again by Shop Committees, on both of which masters and men will find equal representation.

Mr. Corless reported that the painters' and decorators' union had already put the recommendations into effect in their trades and proved its practical character. He was convinced that the principle of democracy applied to industry would solve the age-long labor troubles, for it tapped the greatest resource in industry—the human will. "In England unskilled women, having the will to do their best for war purposes have doubled, trebled and frequently quadrupled the output of skilled men working under conditions of pre-war reluctance." No such results had been attained under the old contract system. The Whitley plan would also have the effect of educating labor as to the conditions of industry and so by increasing knowledge lessen the causes of dispute.

A resolution was passed favoring the investigation of these problems with a view to better co-operation between capital and labor, and directing the attention of other organisations to the subject. The resolutation was moved by Mr. Cole and seconded by Dr. Davidson.

On motion of Dean Goodwin, of Kingston University, seconded by Mr. R. H. Stewart, a resolution was adopted urging the co-ordination of the various technical societies and industrial associations with a view to increasing their value to the nation.

Mr. D. A. Macdougall, president of the Mining Society of Nova Scotia, reported that at the forthcoming meeting of that society a proposal would be submitted for affiliation with the Canadian Mining Institute, thus placing the institute in a position to speak for the whole mining industry of Canada.

Mr. D. B. Dowling, of Ottawa, was elected president by a large majority. This left a third vacancy in the list of vice-presidents, and the following were elected to take their place: Mr. J. A. Dresser, Montreal; Mr. H. E. T. Haultain, Toronto, and Mr. A. E. Whiteside, Coleman, Ont.

For councillors, the following were elected by acclamation: Dr. Alfred Stansfield, McGill University; Mr. N. R. Fisher, Haileybury, Ont; Mr. R. E. Hore, Toronto; Mr. E. P. Mathewson, Toronto; Mr. S. B. Wright, Deloro, Ont.; Mr. Jules Charbonnier, Blairmore, Alta.; Mr. W. P. Williams, Bellevue, Alta.; Mr. R. H. Stewart, Vancouver, B. C.; Mr. George Wilkinson, Victoria, B.C.; and Mr. W. R. Wilson, Fernie, B.C.

On the last day of the convention (8th March) the members were the guests of the Armstrong, Whitworth of Canada, at their works in Longueuil, where electric steel furnaces were shown..

Canada's Mineral Industry After the War

From a Paper Before the Annual Convention of the Canadian Mining Institute, by Dr. Alfred W. G. Wilson, Department of Mines

While the question, "How can mineral production be stimulated after the war?" involves a problem of reconstruction it is well to point out that reconstruction is now in progress, is essential to winning the war and to our maintenance after the war.

No industry established in Canada to-day is absolutely independent of the mineral industry; no resident of Canada is untouched by it. The prosperity of all our industries and the prosperity of all the units of our population are intricately bound up with the prosperity of the industry which supplies many of their needs and without which they could not endure.

Reviewing the Canadian position with respect to the factors of industrial development we now know that we possess many raw materials and large power reserves, in some localities, suitable for commercial utilization; we know that in many cases commercial processes and engineering experience and appliances are available to utilize these natural products. In certain cases new processes may be required. There is some capital available for some developments, but much more will be required. We possess little or none of the real knowledge of home and foreign markets that is essential. Our transportation problems are many, but, so far as the establishment of new industries is concerned, they are specific as applied to special

products and to special markets, rather than general. Questions of Government policies, both at home and abroad, are the most uncertain and disturbing factor, and until there are some pronouncements in this regard important possible developments will be delayed. These delays may be so prolonged as to prevent our entry into markets which are now open to us as well as to other competing producers.

Problems Demanding Consideration and Solution

The development of new enterprises is dependent upon many factors. Each of these might be considered alone and in its relation to all the others. All enterprises, whether private or national, are influenced by Government policy, and the same factors which affect national enterprises will affect private enterprise. The various problems before us for consideration and solution may be grouped in several different ways. In the special grouping selected for presentation on this occasion, the majority of the problems have, for convenience, been associated with "Government policies." The principal subjects for immediate consideration are classified as follows:

1. Financing.—New industries, whether mining enterprises or industries utilizing the products of the mine, will require much capital. How is that to be provided and how protected? The problem of retaining foreign capital already invested and of finding new capital at home or abroad for new industries will require careful consideration.

2. Markets.—Markets for finished products are essential to new industries. Methods of ascertaining what these markets are, where they exist, and what quantities of products they can absorb, must be devised, or existing agencies must be improved.

3. Government Policies.—All influences which Government policies can exert upon the mineral industry and its subsidiaries should be considered in detail, and an attempt should be made to outline the most advantageous line of policy item by item. Under this subdivision the following problems, among others, are of importance.

International Relations

Canada is economically dependent on other territories. We lack many commodities essential to commercial independence, such as supplies of raw sulphur, and other items. We are dependent on outside sources, in part foreign, for much of the iron ores which are converted into pig iron and steel in our blast furnaces. We produce no anthracite coal. Central Canada, in which is located nearly one-half our population, and about one-half of our manufacturing industries, is, at present, directly dependent on the United States for winter fuel, and for steam power. The coal fields of eastern and western Canada could not be developed sufficiently to enable them to replace this foreign fuel supply in less than three years' time, were that supply suddenly withdrawn. Fuel supplied from these fields would not be so satisfactory to the consumer and would cost much more. Our present house heating appliances are not adapted to using this type of fuel, and the people would experience difficulty in learning how to use it properly. Our present transportation systems are not capable of handling the additional traffic that would develop, and would require to be expanded. This expansion would be costly and would require considerable time for effective development.

On the other hand the United States is practically dependent upon Canada for nickel, asbestos, and for certain other products. A very large trade has developed between the two countries in both raw and manufactured mineral products. The most important electro-chemical industries of the continent are located at Niagara Falls on both sides of the International boundary, and are dependent on the electric power generated there. We are reported to possess material reserves of potential power, a portion of which we will be able to exchange for essential commodities that we do not possess, or which are not at present convenient of access. Eventually we will probably control the supplies of coking coals and the by-product industry of the continent.

International relations arising from these conditions will need very careful consideration preceded by accurate investigations, some of which are now in progress.

Federal Control of Basic Industries

It would appear desirable to consider whether some measure of control should not be exercised by the Federal Government both from military and commercial standpoints, in connection with the establishment and location of basic industries, and more particularly with respect to those industries whose products would, in times of war, be diverted to meet munition requirements.

The chief industries concerned would be iron and steel works; metal refineries, including copper, nickel, lead and zinc; plants producing sulphur and plants manufacturing certain heavy chemicals such as sulphuric acid, other acids, and alkalies; electrochemical plants including those utilizing atmospheric nitrogen; and explosive factories.

Public Ownership

The questions of the National interest in all natural resources, the alienation of public interests, and the operation of basic industries for the benefit of the Nation must be considered in detail.

Foreign Control of Basic Industries

At the present time about 80% of the Nickel industry, approximately 90% of the Copper industry, a percentage of the Iron and Steel industry, and nearly the whole of the Heavy Chemical and Fertilizer industry, and portions or the whole of many other industries are controlled by citizens of the United States, and many of the head offices of the companies concerned are located outside Canada. The same is true of many minor industries. In a number of cases the control of the greater portion of the raw materials now produced, and which would be required by industries not now established in Canada, is in foreign hands. At the present time a copper refinery owned by citizens of the Empire would be almost wholly dependent for its supply of raw material in the form of blister copper (90 to 98% pure) on the product of mines and smelters owned by foreigners. The same is true of nickel, sulphuric acid, nitric acid, hydrochloric acid, and many other products.

This condition of affairs gives rise to several problems, the most important of which involve the consideration of ways and means to persuade or compel the foreign owners of basic industries to produce finished products in Canada.

Trade Policies

The trade policies of the nations of the world will have a most profound effect on the development of industries after the war. The effects of trade policies in home markets, in empire markets, and in foreign markets must be considered, and the course most advantageous to us must be charted. For example, it may be pointed out that to permit the export of any raw material that can be manufactured in this country into more valuable finished products will be to our disadvantage and an economic mistake. Studies of trade policies involve the consideration of bounties, import duties, export duties, and national partnership in industry.

Trade Statistics

Information with respect to markets is founded on trade statistics. It therefore becomes necessary to ascertain what information is required, and how can it best be made available to those interested.

Mining Laws

The codification of existing mining laws, and their amendment where necessary, will have to be considered. It may appear desirable to so amend existing laws that we may be assured that in the future the control of important mineral resources shall be vested only in the hands of residents of Canada

or subjects of the British Empire. This action has been taken with respect to natural gas and petroleum resources, and it may be desirable to extend it to other similar resources that are essential for military purposes or to enable us to secure and maintain commercial independence. Such legislation is in force in other countries.

Fraud Legislation

Investors, operators, and the mining industry must be better protected from wild-catting, fake mining schemes, fraudulent advertising, and misrepresentation. This can only be accomplished by a careful study of existing legislation, and the framing of new laws to meet our special needs. Laws framed to promote litigation and increased legal procedure must be scrutinized carefully and revised.

Markets

Increased production from Canadian mines, the refining of many mine products in Canada, and the manufacture of finished articles of various kinds necessitate enlarged or additional markets. It will therefore be necessary to consider not only how to market this excess production, but we must also devise plans to protect ourselves in Empire markets against foreign competition. Associated with this problem is the question of the distribution of our products in the home and in the Empire markets at reasonable cost to the consumer.

National Bureau of Information

The national policy with reference to Bureaus of Information, Scientific Bureaus, Scientific Research, and kindred matters will bear close investigation and careful consideration. At present there are, to all intents and purposes, six bureaus at Ottawa dealing with mineral resources, four dealing more or less with trade statistics relating to the mineral or allied industries; two continuously and two occasionally dealing with water powers, seemingly four dealing with some phases of the fuel situation, and issuing advice to the public, three habitually, and one occasionally considering chemical processes and manufacturing; and seven departments, with nineteen branches, producing maps of various kinds. In addition, eight provinces maintain about eleven organizations dealing more or less effectively with mineral resources, mineral statistics, and power generation. There is a certain measure of co-operation between provincial bureaus and certain of the offices in Ottawa. On the whole it cannot be gainsaid that we lack effective organization, capable administration and adequate leadership in the creation and operation of our bureaus of information with respect to national resources and their utilization.

A word of warning must be added. Experience has shown that very few persons are sufficiently acquainted with Government organizations and responsibilities to speak or write from a national point of view. The hundreds of ideas and suggestions proffered from time to time are almost wholly sectional, and often very personal. These bureaus are established for national service, and as far as possible, should exhibit neither sectional nor personal tendencies. Proffered suggestions as to re-organization can well be confined to general considerations of policy. The details of re-construction and organization should be left to those of broad experience in the public service who are capable of dealing with such matters.

Technical Education

The problem of providing national trade schools and technical education for the benefit of industry must be studied carefully, the necessity for such schools must clearly be shown, and plans that are capable of being carried out must be formulated.

Development of Home Industries

In connection with the further development of the mining industry, and of associated subsidiary industries, and the utilization of our raw materials and power resources for the benefit of our people and for the peoples of the Empire, there are a number of inter-related problems to be considered. Certain phases of these problems have already been outlined; it remains to mention but two phases of this matter.

We must determine what additional industries are capable of establishment, such as metallurgical works and refineries, chemical industries and other manufacturing industries based thereon, and we must consider the function of the National Government in respect to the granting of assistance to such industries, and the nature of the control to be exercised.

Other Problems

The foregoing classification of problems which deserve consideration covers several of the factors involved in planning commercial development. Problems concerned with resources in raw materials and in power, and problems in the development and perfection of processes and appliances are not presented separately for general consideration. There are two reasons for this. In the first place the utilization of natural resources through engineering experience can only be commercially successful under favorable conditions as to capital, markets, transportation, and national legislation. In the second place an enormous mass of material with respect to these resources is already available, most of it is classified and accessible, and existing organizations are continually supplying additional information. I am not oblivious of the fact that there is much overlapping, waste of energy, and inexcusable inefficiency in organization and co-ordination, the responsibility for which must rest upon those in charge of organization and administration. Problems relating to increasing our knowledge of natural resources, or to the development of processes for utilizing them, are specific rather than general. Consideration of these problems can well be deferred until more important and urgent matters are adjusted.

Notes from New York

By F. M. Turner, jr.,

(Correspondence of The Canadian Chemical Journal)

A great deal of interest has been taken during the last few weeks in the claims of a "scientist" who stated that he was able to produce an efficient motor fuel at a cost of less than two and one-half cents per gallon. A committee of capable chemists, including among others, Dr. J. C. Olsen, of the Cooper Institute; Dr. Baskerville, of the College of the City of New York; Dr. Chas. F. McKenna, consulting chemist; Mr. Smith, of Dow & Smith, was appointed. These claims were investigated by government authorities and found to be as was expected, entirely ridiculous. In the presence of the committee of experts the "scientist" prepared his compound from about twenty ingredients, including among others benzol, naphtha, various drugs, essences and extracts. When the mysterious operations were over a liquid was produced which when introduced in the tank of a Ford drove the car successfully. The inventor considered this a proof of the value of his invention, but unfortunately it was pointed out by the experts that many of the separate ingredients entering into his mixture cost considerably more than gasoline. It is well to bear this instance in mind as hardly a week passes without some impostor coming to light in some part of the country with a new scheme of this sort.

On March 18th the Secretary of the Interior reported that the Anaconda Copper Company, of Montana, was entering the manufacture of ferro-manganese. This ferro-manganese has to be manufactured from low grade manganese ores of the Butte mines, which have never been utilized before. A large tonnage of these ores has been developed in opening up mines for their purpose. Mr. John D. Ryan of this company, states the following facts in a letter which is well worth reading carefully on account of the immense importance of an adequate supply of ferro-manganese for the conduct of the war. "In ordinary times these ores would have no value, and to transport them in the raw state and manufacture the ferro-manganese in the East, even under war conditions, is impracticable on account of the

cost, shortage and difficulties of transportation. To manufacture these low grade ores into an 80% ferro-manganese product within a very short distance of where they are produced, by the use of hydro-electric power that is available, without taking it from any other use, seems to me in itself is a matter of much interest in these times; but the greatest accomplishment in doing this will be the release of the equivalent of ten ships of 5,000 tons each now used in bringing manganese from Brazil. These ships can, even under war conditions, providing none of them is lost, carry 300,000 tons of food and material annually from our Atlantic ports to Europe. The Anaconda Copper Mining Company will equip and operate the plant, the installation of which can be accomplished quickly by the use of buildings which the Anaconda Company has available, and which are equipped with cranes, tracks and facilities that would take a long time to provide, if they had to be constructed specially. We think it can be put in operation in about four and a half months. The power is available from the Holter Development, completed within a month by the Montana Power Company, as a reserve and in advance of its market requirements. This plant is capable of furnishing 40,000 killowatts, twenty-four hours daily the year round. The manganese plant will be constructed in Great Falls in the buildings and yards of the present smelter of the Anaconda Company there, and the ores will, as I said above, be produced from the Butte mines."

The offer to erect and equip this plant and go into the ferro-manganese business was made by the Anaconda Company to the War Industries Board and received very prompt and satisfactory attention; every encouragement was promised, and every help obtained to bring about an early completion and operation of the enterprise. The Bureau of Mines of the Interior Department furnished much of the information necessary to determine the feasibility of the project.

At a meeting of the board of directors of the National Aniline & Chemical Company, Inc., on Tuesday, March 12th, the following officers were elected for the ensuing year: President and chairman of the board, William J. Matheson; vice-presidents, Dr. William Beckers, Robert Alfred Shaw, L. F. Stone and Dr. L. C. Jones; treasurer, Henry I. Moody; assistant treasurers, G. W. Yates and T. S. Baines; secretary, William T. Miller; assistant secretary, W. E. Rowley; chairman of the executive committee, Henry Wigglesworth. A statement issued by the company last night said: "The changes in the official staff have been rendered necessary by the decision of the Messrs. Schoellkopf to withdraw from all active management. This decision of the Messrs. Schoellkopf to decline re-election as officers of the company resulted from differences as to the general policies of the company. These gentlemen will retain their large stockholding interests and their places on the board, and will continue to give the company the benefit of their experience and advice. Mr. J. F. Schoellkopf and his brother, C. P. Hugo Schoellkopf, are the real pioneers in the coal tar color industry of this country, aided in recent years by the able co-operation of Dr. J. F. Schoellkopf, jr. They maintained a color business here against every discouragement, from 1879 until the outbreak of the Great War, when the blockade of Germany presented the opportunity for their long deferred and much deserved financial success. It is no exaggeration to say that the Schoellkopf Company in 1914 was one of the two factors which saved from disaster the textile and other trades dependent on the use of dyestuffs. These two factors were the aniline oil produced by the present National Company's works at Marcus Hook, and the direct black derived therefrom by the Schoellkopfs. In the formation and organization of the National Aniline & Chemical Company, Inc., the Messrs. Schoellkopf associated themselves with men connected with the W. Beckers Aniline & Chemical Works, Inc., the General Chemical Company, the Semet-Solvay Company and the Barrett Company, all concerns of prominence in the chemical trade, and also with William J. Matheson, the new president—a director in the General Chemical Company—and for many years active head of a large company engaged in distributing the colors of one of the five great German producers. The burden of carrying forward the National Aniline & Chemical Company will now fall upon these men. Dr. L. C. Jones, whose name appears for the first time as a vice-president, is chief chemist of the Semet-Solvay Company and Solvay Process Company, and he brings to the National Company great strength as chemist and executive."

The Marden, Orth & Hastings Corporation, manufacturers of chemicals and dyestuffs, has secured control of the Calco Chemical Company, Bound Brook, N.J. This acquisition will be a great addition to the manufacturing facilities of the first mentioned concern.

The Monsanto Chemical Company, St. Louis, Mo., a very large manufacturer of synthetic chemicals and drugs, has recently been inconvenienced by a very serious strike. The Department of Justice has undertaken an exhaustive inquiry of this strike.

The chemical firm of Madero Bros., chemical dealers and manufacturers, of New York City, filed involuntary claims for bankruptcy on February 19th. There has been considerable disagreement among the various creditors as to the best method of settling this matter. The concern has considerable assets and it is hoped that they will be able to resume business under some arrangement in the near future. It is understood in local circles that the trouble has been caused very largely by the actions of one of the officers of the firm, acting without the knowledge of the other parties involved.

It is stated in the Manufacturers Record that President Wilson has signed an order releasing funds for the great dam at Muscle Shoals, Tenn. The power plant will cost about $20,000,000 and is expected to develop an industry valued at $200,000,000. It is proposed to develop 680,000 horse power, a large amount of which will be used for the government nitrates plant at Muscle Shoals. The nitrates plant is costing $30,000,000 additional to the amount being spent for the water power development. This nitrates plant is in two sections, one being a synthetic process nitrate plant and the other a cyanamide nitrogen fixation plant similar to that operated by the American Cyanamide Company, at Niagara Falls, Ont. The dam will be one mile long by 105 feet high. Col. Chas. Kelly, U.S.A., is engineer in charge of the power plant construction.

It is stated in the same paper that the Government now contemplates spending $100,000,000 instead of the $60,000,000 announced in February for an explosives plant at Hadley's Bend, near Nashville, Tenn. This plant will provide for a daily capacity of 100,000,000 lbs. of smokeless powder and 100,000,000 pounds of gunpowder in addition to various by-products extensively used in several manufacturing industries.

In connection with this subject the Manufacturers Record quotes the following remarks by Wm. Coyne, V.P., of the E. I. DuPont de Nemours & Company, Wilmington, Dela.: "The United States is furnishing practically all raw materials used in England and France in the manufacture of powder. The men of these countries are all in the ranks, and only crops for feeding the army and the populace are being grown. All cotton, which comprises ninety per cent. of the ingredients which go into the manufacturing of powder, is being furnished by the United States. The only other ingredient of any importance which goes into the manufacture of powder is nitrate. This nitrate is supplied by the nitrate beds of Chile and is brought through the ports of the United States on its way to the powder plants of England and France. A great risk is being run in the transporting of these raw materials from the United States to these countries, and to lessen this risk there is now being contemplated at Washington the establishing of plants in this country for the manufacture of these raw materials into powder and shipping only the finished product. One ship will carry the finished

product which could be manufactured from the cargoes of ten ships loaded with the raw materials. The plans for the construction of the Nashville powder plant are being drawn up in such a manner that the plant can be doubled at any time. Arrangements will probably be made for the doubling of the plant before the first half has been completed."

The Mining and Metallurgical Society of America gave a dinner on March 21st at the Columbia University Club, New York, at which occasion a gold medal was presented by the Society to Mr. Pope Yeatman for distinguished services in the administration of mines.

Mr. Julian C. Smith, vice-president of the Shawinigan Water and Power Company, Montreal, Que., gave a lecture on March 6th at the Johns Hopkins University, Baltimore, on "The Growth of Electric Systems."

The chemical industry of New York City is being organized in an efficient manner for promoting the sale of War Savings Stamps among the employees of chemical manufacturing plants and laboratories. A committee in charge of Mr. Elwood Hendrick meets weekly at the Chemists' Club, New York City, to discuss plans for furthering this object, and it is expected that the chemical industry will make a very good showing in this patriotic enterprise.

Recent Canadian Patents

Of Interest to the Chemical and Metallurgical Industries

180,711. Ore Separator. Geo. E. Keller and Jesse F. Pender, co-inventors, Vancouver, B.C. A process of separating by means of circulation of water in reservoir.

180,762. Carbon Removing Composition. Chas. Adams Lewis, Chicago, Ill. A composition comprising mixtures of alcohol and water, acetone and retardents in various proportions.

180,784. Carbide Manufacture; 180,785, Apparatus for making Carbide; 180,786, Carbide Production; James Henry Reid, Pittsburg, Pa. Claims and drawings are withheld from publication.

180,797. Calcium Carbide Manufacture; 180,798, Production of Ammonia and Compounds; 180,799, Carbide Manufacture; 180,800, Fixation of Nitrogen; 180,801, Calcium Carbide Manufacture. Frank Leroy Slocum, Pittsburg, Pa. Claims are withheld from publication.

180,816. Production of Ammonia and Compounds. George G. Taylor, Crafton, Pa., and Ismond E. Knapp, jr., Caropolis, Pa. Claims and drawings are withheld from publication.

180,864. Alunite Treatment. Frank K. Cameron and John A. Cullen, Washington, D.C. Process of treating alunite with strong sulphuric acid in the manufacture of aluminum.

180,880. Hydro-fluoric Acid. Howard F. Chappell, New York City. A process of producing hydro-fluoric acid from silicon fluoride and hydro-fluosilicic acid by vaporization.

180,925. Cellulose Manufacture. Erik Ludwig Rinman, Stockholm, Sweden. A process of producing cellulose, alcohols, aldehydes and other by-products by boiling in solution and milk of hydrate of lime.

180,966. Coke Production. The Bostaph Engineering Company, Detroit, Mich. A process of producing coke from coal by subjecting the coal to heat, in such a way as to remove by suction the gases of distillation.

181,048. Nitric Acid. Wasili N. Iwanoff, Petrograd, Russia. A method of producing pure nitric acid by maintaining at a certain temperature a suitable solution until condensation produced the pure nitric acid which could be distilled.

181,062. Alcohol Production from Waste Sulphur Lye. Hans Brun Dramen, Norway. The process of producing alcohol from waste lye by treating with saccharines and yeast.

181,178. Pigment. Henry S. Blackmore, Mount Vernon, N.Y. A number of new pigments and paints comprising water, insoluble metal aluminate, zinc aluminate, oils, driers, etc.

181,208. Barium Hydrate Production. Canille Deguide, Ixelles, Belgium. A process for obtaining Barium Hydrate by means of decomposition by water.

181,272. Alkaline Compound. Paul Radmann, Stockholm, Sweden. The production of soluble alkali metal compounds from alkali metal bearing rock by the application of heat.

181,322. Apparatus for locating ore. The Submarine Signal Company, Portland, Maine. An apparatus for generating sound waves and observing their reflection.

Society of Chemical Industry

Canadian Pacific Section

At the January meeting of the Canadian Pacific Section of the Society of Chemical Industry held at the Board of Trade Rooms, Vancouver, Professor Douglas McIntosh, M.A., Ph.D., of the University of British Columbia, addressed the members on "Acetylene," dealing with its discovery and uses.

Acetylene, discovered by the English chemist, Davy, in 1839, was not made available for industrial use until the Canadian, T. L. Willson, produced calcium carbide in an electric furance in 1892. Until recently acetylene was used principally for illumination and oxy-acetylene welding and cutting, the latter having revolutionized the shaping and drilling iron and steel plates, etc. Le Sueur, one of the foremost of our Canadian technical chemists, has contributed largely to our knowledge of the properties of acetylene. The lecturer exhibited some liquid and solid acetylene and some of its compounds with mercury, silver and copper. Acetylene is an endothermic substance and on account of its high content of energy, serves best as a basic material in the synthesis of many common organic compounds. The manufacture from acetylene of acetic acid, ethyl alcohol, acetone and synthetic rubber, and of cyanamide, ammonia and nitric acid from calcium carbide and nitrogen of the air are among the most important recent developments in industrial chemistry. The successful production of acetic acid and of acetone for munitions purposes has been worked out since the war started, at Shawinigan Falls, Quebec, by Mathewson and Reid, the latter being a native of Vancouver and a graduate of the local university. The synthesis is one of the most fundamental and brilliant in the developments of organic chemistry and as a result, large quantities of essential products are being shipped weekly to the Allies for munitions. The first step in the process consists in the combination of acetylene with water using mercury as a catalyst. Acetaldehyde can then be oxidized to acetic acid and this converted to acetone by suitable catalyzers or the acetaldehyde can be hydrogenated in the presence of nickel, thus producing ethyl alcohol. The Swiss Government has subsidized a plant to use this process.

The possibilities for further development were pointed out by the speaker. The opportunity for a local calcium carbide industry was mentioned providing a sufficient market was developed. In British Columbia there are available an abundance of hydro-electric power, pure calcium limestone, coal, water and air, which are the basic materials for the calcium carbide and related industries.

Following an interesting discussion, Mr. J. A. Dawson, the chairman, referred to the Imperial Producers Association, which has been organized to make the Empire self-sustaining and to retain control of the resources of the Empire. It was pointed out that British Columbia was not apparently represented directly in this Association and that it was evidently desirable that we should co-operate in such an Empire-wide organization.

(Signed) J. H. HAMILTON,
Secretary.

Two exceedingly interesting and valuable papers were read and discussed at the February meeting of the Canadian Section, Society of Chemical Industry, held at the Board of Trade Rooms, Vancouver. The first was by Mr. R. Boyd, of the British Columbia Sugar Refinery, on "Chemical Control with Particular Application to Sugar Refining"; the second by Mr. A. A. Heon, of the Vancouver Milling and Grain Company, on "The Chemical Composition of Wheat and Flour."

Mr. Boyd pointed out the necessity for a rigid chemical control at every stage of many of our modern manufacturing processes if these processes are to be conducted as efficiently as present circumstances demand. It is becoming widely recognized that the chemical department of an up-to-date factory is not a luxury, but rather an essential feature of the equipment whereby avoidable losses in the process can be discovered, traced and remedied and the output be maintained at a maximum. Mr. Boyd illustrated his contention by reference to the particular industry with which he is connected, that of sugar refining, and showed, by means of tables of analytical data, how it is possible to check every ounce of raw sugar from its arrival at the refinery to the finished article. Samples of the product at various stages of manufacture were exhibited and described.

Mr. Heon's paper dealt with a topic of considerable interest in these days of food control. He traced our "daily bread" from the soil on which the wheat was produced to the bakehouse and explained in considerable detail how the quality of the wheat (and thus of the flour made from it) varies with the conditions of environment in which it is grown; the same variety of wheat grown on the same soil under different climatic conditions producing grain of very different nutritive value. As a general rule the best quality of wheat for the production of bread flour is grown on a soil which is not specially rich in nitrogen and in a climate where hot dry conditions prevail during the ripening period. For these reasons the Pacific Coast and Vancouver Island are not, in Mr. Heon's opinion, suitable localities for the production of high gluten wheats satisfactory for milling purposes. Most of the wheat grown in the interior of the province makes a good grade of pastry flour. Occasional car load lots, however, from certain interior localities have been found to equal the best prairie wheats and Mr. Heon suggested that these varieties should be grown more extensively. Coming to the question of milling, Mr. Heon explained how the proportion of various parts of the grain which entered into the composition of the flour was under the miller's control and pointed out that the recent orders of the food controller with regard to modification in this respect (whereby 74% of the wheat is included in the flour instead of 72% as formerly) would have an almost inappreciable effect on the quality of the bread produced. If anything, the modification would tend to the production of a more nutritive loaf and for this reason the speaker deprecated the use of the term, "War Bread," and suggested that "Victory Bread" would be a more apposite title.

In the discussion following this paper, the necessity was emphasized of including sufficient milk, butter or uncooked vegetables in our diet to supply the vitamines and inorganic salts without which normal growth and vitality are not maintained. The subject of disease in bread such as "rope" was also discussed and a committee appointed to gather information so as to be prepared in case of any such trouble arising in the province. Mr. Plant, the inspector of city bakeries, was requested to act on this committee.

Ottawa Section

A meeting of the Ottawa Section, Society of Chemical Industry, was held March 21st in the Carnegie Library, Ottawa. About thirty members and their guests were present, Dr. A. McGill presiding.

After the minutes of the last meeting had been read and confirmed a discussion took place regarding the most suitable dates for the annual meeting and convention of chemists. It was resolved that the dates should either be May 20th and 21st or May 23rd and 24th, the matter to be decided by the committee after consultation with the Montreal and Toronto branches.

Mr. Race introduced the question of endeavoring to compile a list of the scientific periodicals and journals that might be available for reference. Mr. Wilson suggested that the parliamentary librarian might be induced to prepare and print such a list and it was resolved on the motion of Messrs. Race and Howard that the co-operation of the other scientific societies in the city be enlisted on behalf of this proposal.

High Explosives

In addressing the meeting on the subject of High Explosives and the chemical problems involved, Mr. I. Grageroff, of Canadian Explosives, Limited, Montreal, stated that there was no simple definition of an explosive. Any substance containing burnable carbon and available oxygen might be regarded as an explosive but the essential feature was that the action should be progressive. The heat evolved by explosives is small compared with oil, coal, and wood but it is generated in a very small period of time and the expansion in volume is exceedingly rapid. The state of sub-division is an important feature in manufacturing a successful explosive and the nearer the particles approach the intramolecular state the greater is the pressure obtained when the charge is fired. Explosives must be capable of detonation. Suitable explosives for different conditions can be designed from thermo dynamic principles, but the results obtained are not so accurate for the complex mixtures as for the simple ones.

One of the most important features of an explosive is the sensitiveness, or ease with which it responds to detonation. This property is often correlated with the density but is not always directly proportional to it. Some mixtures can be made less sensitive by introducing an elastic medium such as gelatin or vaseline. The sensitiveness is also proportional to the temperature. Explosives differ very much as regards the most suitable type of deonator.

The role of sulphuric acid in the manufacture of nitro-glycerine was discussed and evidence was given in favor of the hypothesis that this acid acts both as a dehydrating agent and as a catalyst. This also applies to the manufacture of guncotton but not to the nitration of toluol. The composition of the gas produced during an explosion does not always depend upon the ratio of oxygen to carbon; some compounds contain an excess of oxygen and yet produce CO; others invariably give CO_2, although they contain a deficiency of oxygen. As CO is poisonous the former compounds are not suitable for some purposes.

The temperature of explosion is an important consideration as it may be sufficiently high to cause the propagation of flames in mines. Inert bodies such as water can be added to reduce the temperature and in this case the water acts by increasing the specific heat of the gases. Ammonium nitrate is suitable as the gases produced have very low heats of formation. Common salt is also used and acts by forming a blanket layer round the gases. Ammonium chloride, in the presence of sodium nitrate, forms nascent $NaCl$ which acts similarly.

A letter from Mr. K. S. Machlachlin, in which he tendered his resignation as a member of the committee was read. Action upon the same was deferred till the annual meeting.

Toronto Section

A meeting of the Canadian Section of the Society of Chemical industry was held in the evening of March 21st, at the Engineers' Club, Toronto; Dr. W. L. Goodwin, of Kingston, presiding.

A letter was read by the secretary from the general secretary in London, announcing the loss to the Society by death, suddenly, of the honorary treasurer, Mr. Thos. Tyrer.

A programme giving provisional arrangements for the proceedings of the annual meeting to be held in Ottawa, was being arranged and will be announced at an early date.

A paper by Professor Harcourt on the Methods and Application of Soil Surveys in Ontario, was presented by Mr. Iveson, owing to the unavoidable absence of Professor Harcourt through ill health. Mr. Iveson has been assisting in the execution of this work in the Province and gave a description of the survey, which was carried out largely along the lines of geology and topo-

graphy. By means of special maps, the author showed the effects of glacial action in determining the nature and composition of the soils, and reference was made to the formation of what has been called "Ontario Island" in the highlands of Western Ontario. He claimed that farmers consulting the mapping of the various areas would be able to know beforehand what were the most suitable crops for the various localities without having recourse to sad experience, and not be growing potatoes where turnips should be sown, for example. The work was in its initial stage, and had only reached from the west as far east as Kingston.

The paper brought forth considerable comment and was highly appreciated by those present, as being of real value both scientifically and practically to the agricultural industry of the country.

Industrial News

A large pulp mill is to be erected at Beaver Cove, N.S., in connection with the development by White Brothers, of Boyne City, Mich., of extensive timber limits, purchased some twelve years ago.

The machinery and equipment of the Asbestos Manufacturing Company, of Vancouver, have been purchased by J. K. Bailie & Company, manufacturers of asbestos goods.

An official of the Algoma Steel Corporation states that satisfactory progress is being made on the installation of the thirty new coke ovens, which are expected to be completed by the end of June or early in July. The company's new blast furnaces having a capacity of 400 tons per day, will be blown in this month.

The Canadian Consolidated Rubber Company, Limited, have purchased the property at the south-east corner of Yonge and Front Streets, Toronto, at $47,000.

The Vancouver Gas Company, Limited, have installed new gas retorts, materially increasing their coal gas output. Ammonia liquor, which was formerly wasted, is being made in the new plant and is used by the Victoria Chemical Company, Limited, in the manufacture of chemicals.

The Canadian Food Board has ordered that importers of raw sugar to Canada shall obtain a permit from the Board for the allocation of the sugar for Canadian trade.

The Wallingford Mica and Mining Company, Limited, report great acitivity at their mines at Perkins Mills, Que., and North Templeton. New veins have been found and large quantities of very fine mica taken out, for which there is a good demand.

The Canadian Mining Journal states that the Premier Langmuir Mines, in Northern Ontario, have developed a mine for the production of barytes, largely used in the paint and chemical industries. A tunnel has been run to a length of 100 feet, and a shaft is being sunk. The ore is s id to be remarkably pure and white.

The Asbestos Corporation of Canada has transferred its old Dominion Mill at Black Lake, to East Broughton, and they are now proceeding to develop the Fraser Mines, with a view to meeting the growing demand for raw asbestos.

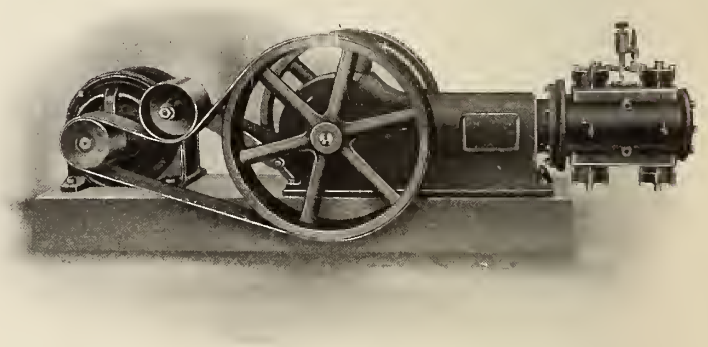
The Manitoba Steel and Iron Company, Limited, was recently organized in the City of Winnipeg, with the following officers: T. R. Deacon, president; H. P. Lyall, vice-president; Walter Stuart, secretary. The company has been incorporated with a Dominion charter, with a capital of $500,000. They have secured an entire block of land on Logan Avenue, and have authority to build and operate rolling mills and blast furnaces, in addition to their other work.

It is stated that negotiations have been entered into for the union of the Mining Corporation of Canada with the Beaver Consolidated Mining Company, in developing the Kirkland Lake Gold Mines.

Colonel Thomas Cantley, chairman of the board of directors of the Nova Scotia Steel and Coal Company, is of the opinion that throughout the year all steel plants in Canada will probably be operating at full capacity, large new munitions contracts being expected from the United States and Great Britain.

The Short-belt Drive for Compressors

In many cases where a compressor is installed space is an important consideration. Very often compressed air is used for various jobs around a plant such as for air-chucks in the machine shop, chipping, etc., in the foundry, and a compressor has to be tucked away somewhere in an existing engine-room. For such cases the short-belt drive is ideal. This arrangement allows the compressor and motor to be mounted on the same foundation, and "compact" is certainly the word. In the ordinary belt drive there must be a certain minimum distance between the pulleys, otherwise the angle of belt-contact on one pulley becomes too small and the belt slippage increases very rapidly. In the short-belt system an idler pulley, carried on arms swung from the compressor frame and free to rise and fall to a certain extent, is mounted to ride the belt on the slack side between the two pulleys. The effect of the idler pulley is to increase the angle of contact on both pulleys and thus decrease the belt slippage. It might be thought that the weight of the idler pulley would add a certain amount to the friction of the belt, but the idler pulley is quite light and is not held down rigidly on the belt hence the very slight added friction is amply made up by the greater efficiency due to the reduction of slippage. In addition to the compactness given by this method—the 10×8 (180 cubic feet) El motor-driven compressor of the Canadian Ingersoll-Rand Company only takes up a space, 11′×3′, motor and all. There is no need for that excessive initial tension which ruins many belts on the long-belt drive. The short-belt drive offers a much cheaper alternative to either gear or chain drive, it is noiseless, and the idler pulley automatically takes up slack in the belt so that there is no need for tightening.



Short-Belt Drive for Compressors

There is one rather important point about the short-belt drive that is frequently neglected. Stick to the alignment and proportions designed by the makers. If, for instance, the motor is mounted slightly farther away from the compressor than intended by the manufacturer, the idler pulley will ride high, the angle of belt contact will be decreased and none of that valuable spring action which is one of the good points of the drive will be available.

It is not advisable to use too thick a belt with the short-belt drive, and "dope" should be used sparingly—if at all.

Education—A War Measure?

By T. Linsey Crossley, Chairman Committee on Technical Education, Pulp and Paper Association.

Our national duty now, apart from the actual recruiting, despatching and maintaining of our forces in the field, is concerned with:

1. Speeding up industry.
2. Speeding up production.
3. Preventing waste.

Can we afford to postpone to the end of the war the consideration of a National system of Education when education is largely the solving power in the three cases of National necessity stated above?

England, France and Germany are busily engaged in intensified technical preparation for the coming of peace and they have well established systems of trade education, continuation schools and special industrial high schools.

Several reasons are given why the Canadian Government should not give time to this question:—(a) It is not a war measure; (b) The Federal government cannot, constitutionally, undertake educational work; (c) It would take so long before any progress is made that it would be no help in winning the war.

Considering these points, we are faced with the statement that (a) it is not a war measure. Going somewhat afield, we find that the educated leaders in Russia found a revolution necessary. They organized and brought about the most remarkable revolution in the history of the world and proceeded to organize a splendid and ideal democracy. In less than a year the whole edifice became a wreck on the sands of illiteracy. From the wreckage emerged the Bolsheviki party. We are inclined to chuckle because it is reported that Bolshevism is spreading in the Central empires with a possibility of their collapse from within. Do the Allies wish to carry on this war and then have to compromise at a conference table with Bolsheviks, Sinn Feiners, and leaders of the I. W. W.? Educational improvement is one of the most imperative measures of national defence.

Provincial rights (b) must be respected. How then can the Government at Ottawa take action? The Royal Commission on Industrial Training and Technical Education* made suggestions and outlined a plan for Dominion action that would enable the Federal Government to support a system of Education receiving all its authority in operation from the Provincial educational organizations. Federal financial assistance would be available to the provinces at their request as certified by the provincial authorities; the only limit being an annual allotment placed at the credit of each province, according to population, the credit to be available even if not called for in any one year.

The excellent report of that Royal Commission has been practically tabled. The time has come to take it from the table. Anyone interested in Canada's future would find that report not only sufficient for immediate action but of exceptional interest throughout.

The industrial chemist, possibly more often than others, realizes the lack of education among the men with whom he must co-operate. How can we expect good control when we have to depend on the assistance of men who cannot use a thermometer and have no conception of the elements of chemistry;?

The writer was in a large plant recently where the responsible head of the department in referring to a vat containing a solution of soda, said it contained an "acid" that seemed to him to be the source of some trouble he was having. To such a man the conception of the functions and possible behaviour of an "acid" embraces any chemical phenomenon and many things also to which the law of the conservation of energy bears no relation.

In many industrial communities, one-mill towns, the chemist or chemical engineer will be the only technical man. There too, his work and personality will determine his acquaintance with the educational leaders of that community. Much would be done for Canadian Industry if the subjects of Chemistry and Physics were given more attention in the schools of small towns. It would not be either difficult or expensive to engage a good teacher of elementary chemistry and physics who would be able to handle several schools in circuit.

One of the greatest handicaps to the progress of education is the feeling that the great function of a school board is to keep expenses down. Recently in one of our small but active industrial towns, a promising night school was started and one of its best features was a teacher of chemistry who delighted in her work and who was able to arouse the interest of her class and maintain it. She asked for fifty dollars a year increase, which had been offered elsewhere. This was refused and she left. Any wide-awake school board would have realized that a good teacher of chemistry in an industrial town is an asset not to be neglected. This loss to the town might not have happened if the manufacturers had seen to it that they were actively represented on the local school board. In the case above cited one of the manufacturers would have paid the money gladly himself.

We must give up the idea that literacy consists in ability to read and write. A case is cited of a young lady who was engaged to marry an engineer. She was found one day studying botany, "because" she said, "my fiance is interested in a plant of some kind and I must be able to talk to him intelligently about his business." That is the kind of illiteracy we must be concerned with.

Our individual interest in Education will have much to do with Canada's industrial future, but we should be acting in some more positive way to overcome the educational shortsightedness that allows our industrial future to be crippled by the miserly attitude of rural school boards. An industrial chemist should certainly be a missionary of education wherever he is, because his living in a large degree depends on it.

* Royal Commission on Industrial Training and Technical Education, Parts I and II, Chapter VII, page 239 and following, "A Dominion Development Policy."

Hardwood Distillation in Canada

Before the Industrial Chemists Club of the University of Toronto on the 6th March, Mr. M. L. Davies, vice-president of the Standard Chemical Iron and Lumber Co. of Canada, delivered an instructive address to the students on the hardwood distillation industry of Canada.

After paying a tribute to the Department of Applied Science of the University which had been honored by the selection of Prof. J. Watson Bain, as scientific adviser to the Canadian War Board at Washington, Mr. Davies congratulated the students on the formation of their industrial club, in the progress of which he was much interested. Their advance happily coincided with the sure, if slow, recognition by the manufacturer, of his dependence on the guidance of the industrial chemist.

In the course of his address Mr. Davies defined the qualifications of the industrial chemist and made a number of suggestions which the students appreciated.

"What" he asked "is an Industrial Chemist? To the man in the street he is somewhat of a mystic but to the average manufacturer the Industrial Chemist is expected to be a walking encyclopaedia. The Industrial Chemist as distinguished from the research and analytical chemist should certainly possess a knowledge of electric matters both as applied to power and to electrolytic work. He must become experienced in the economical combustion of fuel and the utilization of steam for chemical products which depend upon distillation processes. The enormous consumption of fuel in the Chemical Industry plays such an important part in the cost of production that it demands the closest attention of the Industrial Chemist. The analysis of the flue gases escaping into the atmosphere as well as the registering of their temperature often demonstrates that the dollars that should have appeared on the balance sheet have

been volatilized in the smokestack. He should be capable of designing plants and particularly apparatus making due allowance for the varying conditions outside the Laboratory as compared with the ideal conditions within. The ambition of the Industrial Chemist, as a rule, is to discover a new product or a new process but the manufacturer, as well as the Chemist, would often be more materially benefited by the improvement of the process under which they are operating, although conscious of its deficiencies by painful experience.

The Research Chemist discovers a process; the Industrial Chemist applies it. The management of chemical factories should always be in the hands of Industrial Chemists; however able and efficient the superintendent may be, without a knowledge of chemical reaction, he cannot appreciate the conditions governing the operations, and for the want of such knowledge there is danger, and often there is a complete lack of appreciation of the difficulties with which the chemist has to contend. Many Industries are carried on without any chemical supervision at all, involving a loss not only in waste products but by production and yield being much below those obtained under scientific control.

It follows from the foregoing that the under-graduate should specialize for that branch of chemical industry to which he is most attracted. The realm of industrial chemistry is so vast that only a small portion of it can be explored. For most chemical activities the under-graduate would be well advised to give earnest attention to electro chemistry which is still in its infancy notwithstanding its rapid development during the past two or three decades.

If the under-graduate who intends becoming an Industrial Chemist will give serious consideration to these fundamental principles, he will readily realize the importance, and the opportunities, of the profession to which he intends to devote his career.

In connection with the hardwood distillation Mr. Davies referred to papers by J. C. Lawrence before the Glasgow Section, Society of Chemical Industry, November 27th last, and by Dr. John S. Bates, Superintendent of Forests Product Laboratory, Montreal, appearing in May 1917 number of "Canadian Chemical Journal."

Foreign Trade Enquiries

The names and addresses of the firms making these inquiries can be obtained only by those especially interested in the respective commodities upon application to "The Inquiries Branch, The Department of Trade and Commerce, Ottawa." In writing correspondents should quote the number of the enquiry. The initials, "B.T.C." indicate that the enquiry for the address should be directed to the British Trade Commissioner in Canada, 363 Beaver Hall Square, Montreal.

107. Quotations are asked for by a South African office on a very large quantity of creosote. Specifications and other details may be obtained from the Commercial Intelligence Branch of the Department of Trade and Commerce.

121. A Liverpool firm of mine owners and paint manufacturers, who are large consumers of barytes makes inquiry for a Canadian source of supply. Finely ground barytes of good color desired.

122. A Liverpool mines' agent inquires on behalf of a client for antimony mines or deposits to lease or purchase. State fullest details and terms to acquire.

125. A firm in Kingstown, St. Vincent, is inquiring for manufacturers in Canada of liquid carbonic gas for use in making ærated waters.

131. A London, England, firm wishes to purchase sulphide of sodium in 40-ton lots for direct shipment to New Zealand and invites quotations from Canadian manufacturers.

132. A Turin (Italy), firm would be interested in opening up negotatiations with Canadian exporters of wood pulp, asbestos and chemical products.

135. Lubricants, mineral ores, emery wheels, technical specialties and patented articles.—An importer in Milan with important connections desires to hear from Canadian houses interested in exporting to Italy the foregoing articles.

A Glasgow (Scotland) firm of manufacturers desires to get in touch with Canadian buyers of alizarine oils, soluble and finishing oils, soaps of all kinds, certain colors, gums, printing starch mixtures and commodities for both calico printing and finishing purposes. (B.T.C.)

Nicu Steel and Its Manufacture

(From a paper read before the Canadian Mining Istitute, Montreal)

By G. M. Colvocoresses, Humboldt, Ariz

In 1916 the world's production of nickel was 50,000 tons; 85% of this was derived from ores mined in the Sudbury District of Ontario, such ores being essentially a combination of nickel, copper and iron sulphides containing on the average 65 pounds of nickel, 34 pounds of copper and 800 pounds of iron per ton; 75% of all the nickel recovered was used in the form of nickel-steel with average composition of 3.0% nickel and 96.0% iron; in this manner approximately 37,500 tons of pure nickel found employment. In 1916 there were mined 650,000 tons of iron with the nickel ores in the Sudbury District, but all of this was thrown away during the process of treating the ore, while 800,000 tons of iron were drawn from outside sources to combine with the nickel and make up the finished product of alloy-steel. The market value of the iron thrown away from the nickel ores would have been approximately $14,000,000 at the price of 1916, or more than double that figure at 1917 prices.

When the ores of the Sudbury District were first mined and smelted in 1888 and 1889, they were considered principally as copper ores. It so happened that in the particular mines which were first opened, the percentage of copper was considerably higher than the percentage of nickel, and the value of the nickel was considered very problematical. These ores were accordingly treated by a process which was based on the metallurgy of copper and which (with some slight modifications) has been in use ever since.

Let us consider more in detail the treatment of the ore which was mined in 1916 and which contained on the average:

3.25% Nickel,
1.70% Copper,
40.0% Iron,
25.0% Sulphur,
20.0% Silica,
10.0% Alumina, Lime and Magnesia.

The ore was first roasted largely in open heaps where the iron, nickel and copper sulphides were partially converted into oxides and the sulphur reduced to an average of about 10%, and the roasted ore together with some green ore and flux was smelted to a matte in blast or reverberatory furnaces. This matte on the average contained 25% combined nickel and copper, 45.0% iron, and 25.0% sulphur, and it was Bessermerized in a manner similar to copper matte until the composition was approximately 80.0% combined nickel and copper, 1.0% iron, and 19.0% sulphur. The high grade matte was then shipped away mainly for subsequent refining and separation of the nickel and copper by either the Orford or Mond processes. Both of these processes are complicated and expensive and result in a separation of the nickel and copper and the production of nickel metal or oxide and copper metal or sulphate as may be desired and after all that separation three quarters of the nickel was later combined with iron, mostly in open hearth furnaces and eventually converted into nickel-steel, while the copper, of course, was used for various purposes for which this metal is suitable.

The British America Nickel Corporation which will shortly start smelting operations intends to follow the same methods until Bessemer matte is obtained and will then separate the nickel from the copper by roasting, leaching and electrolysis.

By all the present methods, the operators aim to save in one form or another as much of the nickel and copper as possible, but absolutely and deliberately throw away all of the iron and all of the sulphur as well as the insoluble content of the ore. The mechanical and metallurgical losses, moreover, amount to about 20% of the nickel and 17% of the copper mined in the original ore.

Let us assume that in 1918 the value of iron is $30 per ton, the value of nickel 40 cents per pound; copper 25 cents per pound and sulphur (in medium grade of sulphuric acid) two cents per pound, and we find that in round figures, the 1,600,000 tons of ore which should be mined in the Sudbury District in 1918 will have a gross value in nickel of $41,500,000 of which $33,000,000 will be saved and $8,500,000 will be lost. The copper will have a gross value of $13,500,000 of which $11,000,000 will be saved and $2,500,000 will be lost. The iron will have a gross value of $19,000,000 which will all be lost and the sulphur will have a gross value of $16,000,000 which will also be lost in entirety. So the gross value of the useful metals in the Sudbury ore production for this year will amount to a total of $90,000,000 of which $44,000,000 will be saved and $46,000,000 or 51% will be lost. In passing it might be mentioned that the value of the precious metals in this ore will be about $300,000 of which approximately 33% is recovered by present methods. The figures given above are all gross, and, of course, the net value of any metal or product is just the difference between the actual sale price and the cost of production. If it would cost us $46,000,000 to recover the $46,000,000 worth of lost iron, sulphur, nickel and copper, then we would not be at all ahead of the present method from a commercial stand-point by making such recovery; but I firmly contend that a large part of these lost metals can be recovered at a cost which will allow a very nice working profit to the operators. And if, after examination, my statement should appear to be correct, I ask you whether or not Canada can afford to waste annually such a quantity of her resources, valuable at all times but now doubly so in time of war when every nerve must be strained to outgeneral the enemy not only on the field of battle but also in the field of industrial efficiency.

When the first Sudbury matte was sent to the Orford Copper Works in about 1890, it was treated by a process which provided for the recovery of the iron as well as the nickel and copper, but for other reasons this process was not satisfactory and with the development of the present Orford or "salt-cake" process for separating the nickel and copper, the old method was discarded and the iron in the matte was slagged off and lost. So the Sudbury ores have nearly always been treated like copper ores; roasted, matted and Bessermerized and from thereon the process differs from copper metallurgy since it is necessary to separate the nickel from the copper by methods of treatnent which have been developed and perfected over a period of 30 years and which have proved successful and profitable. Nevertheless I claim that the entire present system of treating the Sudbury ore is wrong; that this ore is essentially an ore of iron rather than an ore of nickel and copper and that it should be treated as an iron ore and particularly since the nickel in large proportion must eventually return to a combination with iron in which form it will be actually used, and also because we now believe that the copper may be used in certain combinations with the iron quite as advantageously as the nickel.

In 1901 and 1902, the engineers of the Lake Superior Corporation, (operating at the "Soo") undertook to apply a radically different method to the treatment of the Sudbury ore. They found that some of the ore contained high nickel but very little copper and by utilizing ore of this character (6% nickel and 1% copper) and partly separating such copper as was contained, they sought to produce directly a ferro-nickel. Their work was not a commercial success principally because they could not satisfactorily separate the copper from the nickel, but they had at least an idea which was worth something and to Mr. Sjostedt and Mr. Ulke great credit is due for having started out to make a real improvement in the metallurgy of the Sudbury ores.

At this time I was employed by the Canadian Branch of the Orford Copper Co. where we were re-treating the blast furnace matte produced by the Canadian Copper Co. and raising it to a 72% (combined nickel and copper) matte for subsequent shipment to the Orford Works in New Jersey.

Since 1901 I had continuously borne in mind the possibilities of treating the Sudbury ore as an iron ore rather than as a copper ore and of smelting same to a pig rather than to matte. The development of the multiple hearth roasting furnace provided a means of desulphurizing the ore as far as might be desired and at a comparatively small expense, and the development of the electirc furnaces provided a means of further reducing the sulphur in the calcined ore during smelting and refining to a point far below that required by the specifications for high-grade steels. The copper, however, still remained a stumbling block and to all intents and purposes rendered it impossible to figure out how the ore could be successfully treated in this manner, because no process so far discovered could make a satisfactory commercial separation of the copper sulphides from the nickel and iron sulphides in the ore; yet if one admitted that the presence of copper was harmful to steel and particularly to high-grade steel, it was absolutely necessary that some means should be dévised for making this separation before proceeding with the smelting and refining.

Developments in iron industries were, however, progressing rapidly and metallurgists were more and more frequently inquiring as to the real affect of copper in steel and the bases of the prejudices which existed on this subject. In 1909 Prof. Burgess with Mr. Ashton experimented at the University of Wisconsin on alloys of iron, nickel and copper and came to the conclusion that where pure iron, nickel and copper were mixed in certain proportions and with due regard to the elimination of carbon, the copper was not detrimental to the resultant product but appeared to replace a certain amount of nickel and to affect the steel in practically a similar manner. Mr. Clamer of Philadelphia was also experimenting along the same lines and obtaining similar results, his work being practical as well as theoretical, and his conclusions were summarized in an excellent paper entitled "Cupro-Nickel-Steel" which was presented to the American Society of Testing Materials in 1910. Mr. Clamer took out several patents for the Cupro-nickel steel which he manufactured and for a process for the manufacture of such steel, consisting in the treatment of matte by roasting and smelting with iron ores for the production of alloy-pig which was subsequently refined to steel. This process was a long step in advance since Clamer kept the nickel and copper in combination and also kept a part of the iron which had occurred in the ore in combination with the nickel and copper in his finished product, but he still followed the original system of partly desulphurizing the ore and matting and in so doing a large part of the original iron was slagged off and lost.

Meantime the International Nickel Co. had developed Monel Metal, a natural alloy of nickel and copper, containing about 70% of the former and 27% of the latter, and a little iron and other impurities, and altho this metal was developed mainly in order to provide a substitute for bronze and in some measure a cheaper substitute for nickel, some clever people in the United States seized upon the opportunity to purchase Monel metal-scrap as fast as they could do so and to make with this Monel metal an alloy steel which they passed off as nickel-steel and which in actual practice was found to be just as good as nickel-steel for all practical purposes. This Monel method steel, which was in reality a nickel-copper-steel, passed all the tests of the United States Government and entered into the manufacture of a large number of armour piercing shells and was also utilized to a

considerable extent for automobiles and in other industrial lines of manufacture requiring a high-grade alloy-steel, and as far as I have ever been able to learn the Monel metal steel lived up to the requirements of the manufacturers and users just exactly as well as the nickel-steel which it replaced at a considerably lower cost.

These developments showed that nickel and copper might be combined to form an alloy steel without any disastrous effects resulting from the presence of the copper and if Monel metal representing the combined nickel and copper in the Sudbury ores might be mixed with outside iron to form an excellent alloy-steel, why was it not possible to retain with the nickel and copper the iron originally combined with them by nature and to manufacture therefrom a steel that would be equally good?

So I went back over all my old ideas, notes and experiments in Canada, New Caledonia, Cuba and elsewhere seeking a practical method of treating the Sudbury ore along the lines of these ideas. The result was the process for the direct manufacture of nickel-copper alloy-steel from the Sudbury ores and from the furnace slags which had been made in that district and for the production of an alloy-steel which we now call by the trade name of "NICU STEEL" and which has been manufactured in the laboratories and on a small scale at intervals during the past five years and under commercial conditions for the first time at East Montreal during the fall of 1917.

Our process in principle is very simple. The treatment of the ore is based upon the assumption that the Sudbury ores are primarily iron ores rather than nickel-copper ores and that the ternary alloy which has been formed by nature in those ores is a valuable one to convert into actual commercial use, providing the proportions of the three metals combined therein are properly regulated and the combination made complete and homogeneous. The Nicu Steel produced is, therefore, in reality a modified natural alloy and we remove the main objection to natural alloys, (which is varying composition of the product) by so mixing the ores as to assure a practically uniform composition, and by adding during the process additional iron bearing material which will reduce in proportion the content of nickel and copper if this be higher than desired, or by mixing the ores with Sudbury slag in order to insure the same result.

The ore as taken from the ground contains 25% sulphur which must be removed before it can be treated in a blast furnace, or electric furnace, hence the first step in the process consists in crushing the ore to the necessary fineness (which we now find need not be less than ½ inch) and in roasting it quite sweet so that the resultant calcines contain not more than 0.50% sulphur and in practice we have been able to easily reduce this sulphur to 0.30%. The roasting, of course, requires some fuel but not a great deal since the ore once ignited in a proper furnace will roast itself down to 3 or 4% sulphur, requiring fuel to drive off only the balance of the sulphur contained. We believe that at some future time when we are able to provide the most satisfactory equipment for carrying out this process on a large scale, the roasting will be carried on in multiple hearth roasters and that with such equipment the sulphur can be recovered at a profit and manufactured into sulphuric acid or possibly into metallic sulphur by the Hall or Thiogen process or some other process which may be developed later. I do not intend at present to dwell upon the value of the sulphur contained in the ore because I do not yet know that it can be utilized with commercial profit considering all the conditions of the industry, but this is a subject which holds out great promise for the future and which should be carefully studied. I think that a large percentage of the sulphur in the ore can be recovered in a useful form with profit to the operating company and with advantage to the Canadian industries employing sulphur of which there is at the present time a very considerable shortage. In 1915, 46,000 tons of sulphur was imported into Canada and imports at present must be far larger, yet 400,000 tons of sulphur are sent up annually in smoke from the Sudbury ores.

(Concluded in next issue)

MINERAL PRODUCTION OF CANADA FOR 1917

Preliminary report by John McLeish, chief of Division of Mineral Resourses

It is customary to express the total mineral production and to make comparison of production in different years in terms of dollars, or total values.

On this basis of record and comparison the total value* of the metal and mineral production in 1917, as shown in this preliminary report, was $192,982,837. Compared with a production in 1916 valued at $177,201,534, an increase of $15,781,303, or 8.9 per cent. is shown, while compared with a production in 1915 valued at $137,109,171, there is shown an increase of $55,873,666, or 40.8 per cent.

It must not be inferred, however, that because such a large increase is shown in the value of our mineral production, that our mines and quarries have actually increased their tonnage output at the same average rate. In fact, an examination of the record will show that the quantities of many important products were considerably less in 1917 than in 1916, and over two-thirds of the increase in value is to be attributed to coal, gypsum and cement, in which the quantities marketed were less than in the previous year.

The interrelation of industry is shown by the effect of a diminished coal and coke output on the metallurgical production, the falling off in production of copper and gold is in part attributable to this cause. Lead and silver also show much smaller output. As against these decreases there has been an important increase in the production of zinc, and increases also in the production of cobalt, molybdenite, and nickel.

In 1916, the metal production showed a very large increase over that of the previous year, but in 1917 the net result in value has been an increase of only $311,387, making a total value of $106,630,752.

The total value of the non-metallic production, including clay and quarry products in 1917, was $86,352,085, as compared with $70,882,169 in 1916, showing an average increase of $15,469,916, or 26 per cent. Practically every product, with the exception of the stone quarry output, shows an increased value of production; but in the case of coal, graphite, gypsum, and cement, the quantities actually marketed were less, notwithstanding the increased values.

Copper

The production of copper in 1917, amounted to 108,860,358 pounds, valued at $29,588,254, as against 117,150,028 pounds valued at $31,867,150 in 1916, a decrease of 7.08 per cent in quantity and 7.15 per cent. in value. Though less than the previous year, the 1917 production was greater than any other previous record. In 1916, the increase over the production of 1915 had been 16.2 per cent. in quantity and 83.0 per cent in value.

The electrolytic copper refinery installed at Trail, B.C., began operations about November 1, 1916, with a capacity of 10 tons of refined copper per day, which has been increased to 20 tons per day. Of the total 1917 production, 86,508,758 pounds were contained in blister copper and in matte produced in Canada, and 22,351,600 pounds estimated, as recovered from ores exported. In addition to the recoveries from domestic ores, there were also recovered in British Columbia smelters, 5,033,630 pounds of copper from imported ores. The production in Quebec from pyrite ores was 5,013,560 pounds, valued at $1,362,636, as against 5,703,347 pounds valued at $1,551,424 in 1916. These are the quantities reported as being paid for; the actual metal contents were much higher. The Ontario production is derived chiefly from the nickel-copper ores of the Sudbury district and of the Alexo mine in Timiskaming supplemented by a small recovery from the Cobalt district silver ores and by shipments made from a few copper properties under development. The

*In presenting a total valuation of the mineral production as here given, it should be explained that the production of the metals copper, gold, lead, nickel, silver, and zinc is given as far as possible on the basis of the quantities of metals recovered in smelters, and the total quantities in each case are valued at the average market price of the refined metal in a recognized market. There is thus included in some cases the values that have accrued in the smelting or refining of metals outside of Canada.

total production in 1917 amounted to 42,796,213 pounds valued at $11,632,014 as against 44,997,035 pounds valued at $12,240,094 in 1916 a decrease of 4.0 per cent in quantity. There was an important copper production in Manitoba in 1917 derived from the ore deposits at Schist Lake north-west of the Pas, operated by the Mandy Mining Company. These sulphide ores as well as those at Flln Flon Lake in the same district have had a very large amount of development work expended upon them during the past two years. The ore shipments which amounted to 3,388 tons were made under great difficulty of transportation having been hauled 40 miles by sleigh in winter, then 190 miles by barge during summer and then 1,500 miles by rail to the smelter at Trail. The British Columbia production was 57,717,535 pounds valued at $15,687,631, as against 63,642,550 pounds valued at $17,312,046 in 1916—a decrease in quantity of over 9 per cent. The production included 40,720,413 pounds recovered in blister and matte and 16,997,122 pounds being the estimated recovery from ores shipped to United States smelters. The production from the Yukon in 1907 amounted to 2,182,050 pounds valued at $593,081, as against 2,807,096 pounds valued at $763,586 in 1915. The production is derived from the mines of the Whitehorse district in southern Yukon.

Lead

The earlier estimates of the production of lead in 1917 included the recoveries of considerable quantities of lead from imported ores. The total production in 1917 of lead in bullion credited to Canadian mines together with the lead estimated as recoverable from ores exported was 32,072,269 pounds which at the average price of lead in Montreal 11.137 cents per pound would be worth $3,571,889. The corresponding production in 1916 was 41,497,715 pounds valued at $3,532,692, an average price of 8.513 cents. The decrease in quantity was 9,425,346 pounds, or 22.7 per cent but on account of the higher price there was a slight increase in total value.

There is such a divergence between the records of lead contents of ores and concentrates shipped and recoveries at smelters from domestic and imported ores that the following records are presented for comparison.

	1916 Pounds	1917 Pounds
1. Production: Smelter recoveries from Canadian ore and recoverable lead in ore exported	41,497,615	32,072,269
2. Lead contents of ores and concentrates shipped from mines in Canada	54,124,628	37,624,567
3. Total production of lead bullion in Canada (including lead from imported ores)	43,100,236	41,427,304

The 1917 production included 30,077,230 pounds of lead in bullion of which a large portion was electrolytically refined and 1,995,039 pounds recoverable from ores exported. The lead bullion was produced chiefly at Trail with small contributions from smelters at Kingston and Galetta, Ont. (The total producduction of the smelters including lead from imported ores was as noted above 41,427,304 pounds.) The lead ores exported were derived from Notre-Dame des Anges, Que., the Surprise mine, Slocan, B.C., and the Silver King mine at Mayo, Yukon.

The total mine shipments of lead ores and concentrates was about 58,801 tons containing 37,624,567 pounds of lead as compared with shipments in 1916 of 84,516 tons containing 54,124,628 pounds of lead.

The exports of lead in 1917 were lead contained in ore concentrates, bullion, etc., 13,410,400 pounds valued at $925,056. Exports in 1916 were: Lead in ore, etc., 9,048,400 pounds valued at $558,180 and pig lead 112,100 pounds valued at $7,710.

The average price of lead in January was 9.50 cents per pound advancing to a maximum of 14.62 cents in June and falling again to 7.92 in November, and 7.96 in December, the average for the year being 11.137 cents. This is the producer's price for lead in car lots as per quotations furnished by Messrs, Robertson and Company.

Nickel

The production of nickel in 1917 has, as usual, been derived from the ores of the Sudbury district supplemented by the recovery of a small quantity of metallic nickel, nickel oxide, and other nickel salts as by-products in the treatment of ores from the silver-cobalt-nickel ores of the Cobalt district. The total production was 84,470,970 pounds, worth, at 40 cents per pound. $33,778,388, compared with 82,958,564 pounds valued at $29,035,-497 or 35 cents per pound, in 1916.

Sudbury District: The total production of nickel-copper matte at the smelter of the Canadian Copper Company and the Mond Nickel Company in the Sudbury district was 78,897 tons, containing 83,773,319 pounds of nickel and 42,392,588 pounds of copper, the average percentage of the combined metals in the matte being about 80; the tonnage of ore smelted (part being previously roasted) was 1,453,661 tons, which as usual included a small tonnage from the Alexo mine in the Timiskaming district. The production in 1916 was 80,011 tons of matte derived from 1,521,689 tons of nickel-copper ores smelted, the matte containing 82,596,862 pounds of nickel and 44,859,321 pounds of copper.

The refinery under construction at Port Colborne, Ont., by the International Nickel Company, had not been completed at the close of the year. The British American Nickel Corporation continued the development of its nickel properties particularly at the Murray mine, and work was begun on the first unit of the smelter a mile distant from the Murray mine. It is expected that construction work on the refinery will begin early in 1918.

Nickel was recovered as a by-product in smelters at Deloro, Thorold, and Welland, from the silver-cobalt-nickel ores of the Cobalt district; complete returns have not yet been received, but the total nickel contents of nickel oxide, nickel sulphate, and metallic nickel produced have been estimated at about 697,000 pounds. The products recovered in 1916 included 79,360 pounds of metallic nickel; 323,418 pounds of nickel oxide, and 232,45 pounds of nickel sulphate, having a total reported value of $132,896 and containing 361,701 pounds of nickel metal.

The imports of nickel into the United States during the eleven months ending November, 1917, which included small quantities from other sources as well as from Canada, are recorded as 69,265,880 pounds, containing in ore, matte, or other form valued at $8,869,824, or an average of 12.81 cents per pound. The exports of nickel and nickel oxide, etc., during the same period were 21,430,306 pounds, valued at $8,702,727, or an average of 40.61 cents per pound, of which about 66 per cent were consigned to Great Britain and 30 per cent to Italy and France.

The values per pound of these exports to different countries ranged from 38.5 cents to 48.6 cents per pound. The average value per pound of exports in 1916 was 38.775 cents, the range being from 37.13 cents to 45.21 cents. The average export value in 1914 was 34.26 cents. The price of refined nickel in New York according to quotations published by the Engineering and Mining Journal continued at from 45 to 50 cents per pound for ordinary forms, with 5 cents more per pound asked for electrolytic nickel, until March 7, from which date the quotation was from 50 to 55 cents.

(Contiuued in our next issue.)

The summer meeting of the American Institute of Chemical Engineers, will be held in Berlin, N.H., June 19th to 22nd. Headquarters will be at Mt. Madison House, Gorham, N.H. The secretary of the Institute is Dr. J. C. Olsen, whose address is, Cooper Union, New York City.

Mr. A. MacKinnon, of the Kingston, Ont., Smelting Company, is undertaking in cooperation with New York friends, to find a use for the deposits of barite found in the district north of Kingston. It is understood that the mineral will be converted into barium carbonate and the product will be sold to the paper and paint industries.

Correction

Mr. A. Martin, chemist at the Canada Sugar Refining Company, Montreal, informs us that the statement attributed to him by a Montreal paper, quoted in this JOURNAL last month, was incorrect, as to the length of time it would take a graduate chemist to acquire a knowledge of sugar refining. What Mr. Martin explained to the exemption tribunal was that he had been in the employ of the company fourteen or fifteen years and during this time had obtained information on the refining of sugar which a recently graduated chemist could not have and could only obtain by practical work.

Personals

Mr. G. H. Macdonald, steel analyst with the Algoma Steel Coporation, Sault Ste. Marie, paid a brief visit to Toronto a few days ago.

Mr. Leighton M. Long, for the last two years with the Kawin Company, of Toronto, is now assistant chemical engineer at the works of the Dominion Tar and Chemical Company, Sault Ste. Marie, Ont.

Mr. Arthur Lyman, of Lymans, Limited, and Mr. A. W. Gifford, of Wilson, Paterson & Company, represent the chemical industries on the new council of the Montreal Board of Trade.

Dr. A. McGill, chief chemist, Department of Inland Revenue, after attending the meeting of the Joint Committee of Technical Organizations in Toronto, proceeded to Pittsburgh, Pa., where he will investigate questions relating to gasoline.

Mr. Wm. McMaster has been elected vice-president of the Asbestos Corporation of Canada, in succession to Mr. H. E. Mitchell, of Philadelphia, who remains on the board of directors.

Dr. E. P. Wightman, formerly a research chemist for Parke Davis and Company, Detroit, Mich., who enlisted in the 30th Engineers Regiment, U.S.N.A., and was later transferred to the Chemical Service Section, a new branch of the United States army, has been promoted to 1st Lieutenant and has been sent to the overseas laboratories.

Dr. Chas. H. Higgins, for many years chief pathologist of the Dominion Department of Agriculture, has resigned to become Canadian representative of the Lederle Antitoxin Laboratories of New York. Dr. Higgins' headquarters in his new position will still be in Ottawa.

Thomas J. Brown, formerly general superintendent of the Nova Scotia Coal and Steel Company, has taken an official position with the Dominion Coal Company.

The city engineer of Hull, Que., Mr. J. P. A. Laforest, has accepted a position with a mining firm in New York, as consulting engineer.

The Hon. W. J. Hanna, K.C., former Food Controller, has been elected president of the Imperial Oil Company, Limited, in succession to Mr. Walter C. Teagle.

Mr. Clarence S. V. Hawkings, chemist at Nobel's Limited, is taking up work in one of the chemical works at Shawinigan Falls, Que.

Among the demonstrators in McGill University last year the following are now doing work in connection with the war: M. J. Marshall is with the Shawinigan Electro-Metals Company, Shawinigan Falls; C. F. Hamill is at New York State College of Forestry, Syracuse, N.Y.; W. J. Geldard is engaged on war work for the American Government; and G. L. Magoun is with the DuPont Powder Company, Wilmington, Del. Of the graduates of last year the following have taken positions: E. A. Charlton with the Abitibi Power and Pulp Company; E. A. Cushing, with J. T. Donald & Co., consulting chemists, Montreal; A. G. Jacques has enlisted with the Canadian Siege Battery; L. E. Johnson is in the Internal Revenue Department, Ottawa; J. B. Poole, with Milton Hersey Company, consulting chemists, Montreal, and A. W. Walter with R. W. Hunt Company, engineers, Montreal.

Notes

Geological survey experts have estimated that 20,000,000,000 barrels of crude oil capable of furnishing 2,000,000,000 barrels of gasoline could be recovered from Colorado's shales.

Government scientists in India have succeeded in making paper from three new materials. The leaves of a west Australia plant, timber from East Africa, and bark of a tree found in Rhodesia.

Another recent achievement of an American Chemist is the perfecting of a process for treating cotton cloth for the making of a suitable gas mask for use in the second line trenches. A product has been obtained which withstands the effect of cold and hard usage.

The solution of many of the most difficult and important problems created by the war has been accomplished by the chemists of the allied nations. The aviation branch of the service which has developed so rapidly presents many problems difficult to overcome among the chief of which is the numbing effect upon the aviator of the cold, wind and rain at high altitudes. In this connection a Canadian chemist has perfected an invention whereby the inside of an outer garment can be kept at a comfortable temperature by means of a net work of fine wires connected with a small electric generator in the machine and now an American chemist has perfected a process of treating cotton cloth for garments so as to render it water-proof and unaffected by the low temperatures and high winds experienced at high altitudes.

Joint Committee of Technical Organizations

The second annual meeting of the Joint Committee of Technical Organizations, formed to bring the various technical bodies into closer communion, was held in Toronto on March 25th, Mr. Alfred Burton presiding. There was a large attendance.

Mr. Burton, as chairman, reviewed the work of the committee for the past year. In assisting the Imperial Munitions Board the committee made detailed reports on nearly one hundred inventions relating to the war, this work being handled by a sub-committee. Another sub-committee was formed to make a study of airplane improvements and is collecting data with a view to maintaining its service after the war. Mr. Burton called attention to the way in which the ranks of civil engineers were being depleted and said the committee was now considering means of restoring the balance by increasing the attendance in the engineering faculties of the universities. The preparation of a catalogue of technical reference books, the training of the blind and vocational training for returned soldiers, were other features of Mr. Burton's address.

Colonel David Carnegie, of the Imperial Munitions Board, gave an address on lines corresponding to his address at the Canadian Mining Institute, reported elsewhere, dealing with the relations of government to industry, and the problem of employment for returned soldiers.

Mr. W. E. Segsworth, administrator of the vocational branch of the Military Hospitals Commission, told of the work now being done for invalided soldiers in Toronto.

Mr. H. H. Couzens, of the Toronto Hydro Electric Commission, was elected chairman. Mr. Wills Maclachlan was re-elected secretary, and Mr. W. A. Bucke, treasurer.

The following representatives of various organizations were elected to serve on the general committee:

Canadian Mining Institute, W. E. Segsworth; Canadian Society of Civil Engineers, Prof. L. M. Arkley; Association of Ontario Land Surveyors, Russell R. Grant; Society of Chemical Industry, E. P. Mathewson; Engineering Alumni Association, University of Toronto, H. G. Acres; Engineering Alumni Association, Queen's University, Alex. C. Longwell; Engineers' Club, W. A. Bucke; Royal Canadian Institute, Harry Jewell; Canadian Manufacturers' Association, G. M. Murray; Canadian Engineers, Military District No. 2, Major L. L. Anthes; American Society of Mechanical Engineers, C. B. Hamilton; American Institute of Electrical Engineers, W. G. Gordon; Institution of Electrical Engineers (England), S. L. B. Lines; Ontario Association of Architects, R. K. Shepard.

Chemical and Metal Markets

The Quotations below represent average prices for the quantities indicated. Larger quantities may be obtained at lower figures.

TORONTO, March 27th, 1918.

The chemical and metal markets have been characterized by a little more steadiness during the past month, and the chief troubles are those due to the disorganization of railway traffic combined with the delays caused by the Government licensing and embargoes placed on traffic between the United States and Canada. The new Canadian War Mission at Washington is expected to do much to bring order out of chaos for the chemical industry, though it cannot be expected to remedy the delays on the railways. These delays are serious. A typical case is that of a chemical dealer who was advised of a shipment of a car load from Philadelphia early in February. The car cannot be located anywhere and many customers depended upon the receipts of the contents. To avoid such delays a general resort is had to the express service, but here again the express companies which are owned by the railways have become indifferent and either neglect on refuse to take consignments or lose sight of them when crossing the boundary line.

There has been a good demand for arsenic, ammonia and soda compounds, while dealers in alum ar asking higher prices.

It is expected that the new chemical works of the Brunner Mond, of Canada, located at Amhertsburg, Ont., and operating the Solvey process as at Syracuse will be ready to produce soda ash, etc., soon, thus adding an important item to the chemical industries of Canada.

The scarcity of some coal tar products has led to an advance in prices asked, as for example, toluol which the American Government does not release in any large quantity.

There has been a decline in caustic soda values, owing to the large and steady output coupled with restriction on the export. Sales have been made in New York as low as $4.25. The same may be said of chlorate of potash.

In the metal market a striking feature of the month has been the advance in tin which has gone up to $1.00 a pound, a rise due chiefly to the difficulty of getting sufficient supplies by ship from China, Straits of Malacca and other sources. Prices in New York for American tin are quoted at 82 to 85 cents.

The embargo on aluminum from Great Britain still holds, and Canadian consumers have to depend on what can be picked up in the United States. In Toronto 65 cents is quoted as a base price; but in the United States the Government has fixed the base price at 32 cents a pound at the place of production.

At the end of February all supplies of platinum were commandered by the American Government and prices fixed at $105 per ounce for pure and $113 for ten per cent. iridium.

The iron and steel trade is fairly good and prices steady. The blowing in of the new furance at Sault Ste. Marie; the Canadian Government's decision to arrange for a large mill at Sydney, N.S., to roll steel plates specially for the shipbuilding trade, and the proposal for a steel industry on the Pacific coast will help to give more completeness to the steel trade of Canada.

Acetanilid, C.P.	Lb.	1 10—1.20
Acetic acid, commercial, crude, 28%, in bbls.	Lb.	.7⅞—.8½
" " 80 per cent. pure	Lb.	.29—.33
Acetone	Lb.	.50— 55
Alcohol. grain, bbl	Gal.	7.50
Alcohol, methylated, .bbl	Gal.	1.60
Alcohol, wood, 95 per cent., refined	Gal.	1.55
Alum, ammonia lump	100 Lbs.	$4.00—5.50
Aluminum Sulphate, high grade, bags	100 Lbs.	2.00—3.00
Ammonia, Aqua .880	Lb.	.13
Ammonium Carbonate	Lb.	.14
Aspirin (acetyl salicylic acid)	Lb.	4.00
Benzoic Acid	Lb.	6.00—7.00
Bleaching Powder, 35% drums	100 Lbs.	3.50
Borax, crystals	Lb.	.09½—.10
Boric Acid, powdered	Lb.	.17
Calcium Chloride, fused, in drums	Lb.	.2½
Carbolic Acid, white crystals	Lb.	.90—.100
Carbon Bisulphide	Lb.	.10—.15
Caustic Soda, ground, Bbl	Lb.	.07—.08
China Clay, imported	per ton	$25—$30
Chloroform, com	Lb.	.75—.90
Citric Acid, domestic, crystals	Lb.	.85—.90
Cobalt Oxide, black	Lb.	1.50—1.75
Copper Sulphate (Blue Vitriol)	Lb.	.11—.12
Fuller's Earth, powdered	100 Lbs.	6.00
Glycerine, 56 lb. tin	Lb.	.80
Hydrochloric Acid, carboys, 18°	Lb.	.03¼—.03¾
Lead Acetate, white crystals	Lb.	.20
Lead Nitrate	Lb.	.18—.20
Magnesium Carbonate, B.P., bbl	Lb.	.16—.17
Nitric Acid, 36° carboys	100 Lbs.	9¼—9¾
Oxalic Acid	Lb.	.55
Phosphoric Acid, S.G. 1750	Lb.	.75
Potassium Bichromate	Lb.	.70—.75
Potassium Bromide	Lb.	2.00—2.25
Potassium Carbonate 90 to 95%	Lb.	.85—95
Potassium Chlorate, crystals, Kegs	Lb.	.50—.60
Potassium Nitrate......, Kegs		(Nominal)
Potassium Permanganate, bulk	Lb.	4.00
Salicylic Acid	Lb.	1.25—1.50
Silver Nitrate	Oz.	.90—.95
Soda Ash, bags	Lb.	.03½—.04
Sodium Acetate	Lb.	.20—.22
Sodium Bicarbonate, 100% pure	100 Lbs.	3.75—4.00
Sodium Bichromate, bbls,	Lb.	.23—.25
Sodium Cyanide, bulk, 98-99 per cent, in cases	Lb.	$ .45
Sodium Hyposulphite, kegs	100 Lbs.	3.00—3.75
Sodium Nitrate, refined	100 Lbs.	8.00
Sodium Silicate, according to density	100 Lbs.	4.00—5.00
Sulphur, ground	100 Lbs.	3.50—4.00
Sulphur, roll	100 Lbs.	5.00—6.00
Sulphuric Acid, 66°Be, carboys	100 Lbs.	3.25—3.75
Tannic Acid, commercial		(Nominal)
Tartaric Acid, crystals or powdered	Lb.	.80—.90
Tin Chloride, crystals	Lb.	.70
Zinc Sulphate, com	Lb.	.6½

Metals

Aluminum, No. 1, 98-99% ....base price	Lb.	.50—.60
Antimony	Lb.	.18—.19
Arsenic, white	Lb.	.15—.17
Brass, yellow ingots	Lb.	.18—.20
" red	Lb.	.25
Cobalt, metal	Lb.	2.25
Copper, casting	Lb.	.29
Copper, electrolytic	Lb.	.30
" Am. Government price (electrolytic and casting	Lb.	.23½
Iron, bars	100 Lbs	5.25
Lead	Lb.	.09
Magnesium	Lb.	2.50
Mercury	Lb.	1.50—2.00
Nickel, electrolytic	Lb.	.50—.55
Platinum, pure	Oz.	105.00
Silver, bar	Oz.	.92—.93
Spelter	Lb.	.09
Steel, mild	100 Lbs	5.50
" nickel, in bars, 3½% Nickel	Lb.	.25—.26
" sheet, Bessemer, 28 gauge	100 Lbs.	8.00—9.00
Tin	Lb.	1.00

"ACME" SPRAYING PRODUCTS

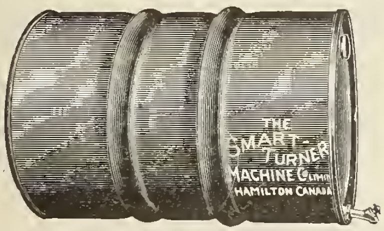
ARSENATE OF LIME — BORDEAUX MIXTURE
LIME SULPHUR SOLUTION — NICOTINE SULPHATE

ACME NICOTINE KEROSINE SULPHUR SOAPS

ACME LABORATORIES, Limited
263-265 YONGE ST. and 132-134 RICHMOND ST. W. TORONTO

THE NEW BARREL

Made of Steel



Made in Canada

The Smart-Turner Machine Co. now produces steel barrels in many styles and sizes, for Oils, Gasoline, Chemical and Mineral Products. Make known your wants to

THE SMART-TURNER MACHINE CO.
HAMILTON CANADA

DAYLIGHT SAVING

Clean white walls will throw daylight or artificial light into the dark corners of your factory, warehouse or office. This means greater production and more workable space.

PAINT WITH

Crown Diamond Factory and Mill White

Made in Flat or Gloss Finish

It is Durable, Washable and Very White

WRITE FOR ESTIMATE

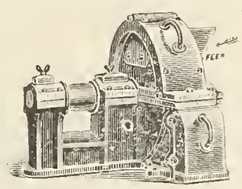
McARTHUR, IRWIN, LIMITED
MONTREAL — ESTABLISHED 1842 — TORONTO

U. S. Acid Proof Paint

SEND FOR SAMPLE ON TIN--READY TO TEST

Absolutely proof against the strongest acids and alkalis—even proof against chlorine—air dries in 30 minutes—will stand 350° Fahr. Contains no oil, asphalt, coal tar or pigment.

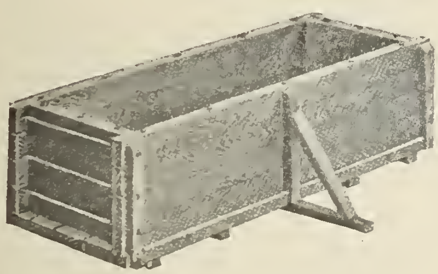
U. S. VARNISH Co. 41 Park Row, N.Y.



DISINTEGRATORS

ALL TYPES OF
GRINDING, SIFTING, DRYING and SEPARATING MACHINES

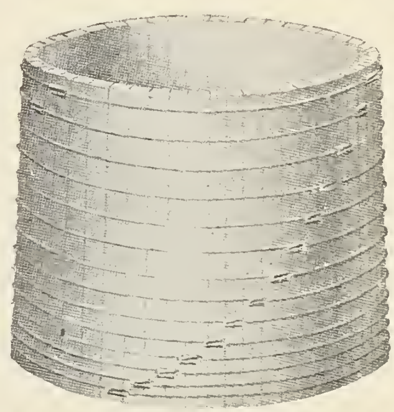
J. HARRISON CARTER LTD.
DUNSTABLE and LONDON, 12 Mark Lane
ENGLAND



Wood Tanks

ANY SIZE

FOR ALL PURPOSES



Goold Shapley & Muir Co., Limited
BRANTFORD, CANADA

ANILINE DYES

MANUFACTURED BY

THE SCHOELLKOPF WORKS, BUFFALO, N.Y.

Basic, Acid, Direct, Union and Chrome Colors

Special Attention Given to the Matching of Shades

CANADIAN ANILINES & CHEMICALS LIMITED
14 FRONT STREET EAST - - - - TORONTO, ONT.

Index of Advertisements

EMPLOYMENT DEPARTMENT

The charge for condensed advertisements of "Engagements Wanted," or "Positions Open," is 50 cents per month for advertisements of 40 words or less, no charge being made for the use of box numbers in care of CANADIAN CHEMICAL JOURNAL.

ENGAGEMENTS WANTED

Young man, graduating from University of Alberta, desires position as chemist. Organic work preferred. Not liable to be drafted. Address: N. M. Stover, 11117 88th Avenue, Edmonton S., Alberta.

Chemist, B.Sc., Canadian, 27, desires change. Research experience in metallurgy and organic chemistry. Experience in metallography, micro-photography, organic analysis, testing of lubricants; liquid, gaseous and solid fuels; analysis of ores and non-fereous alloys. Salary must be attractive. Apply Box 12, CANADIAN CHEMICAL JOURNAL.

Chemist, graduate in chemistry, and mineralogy, faculty of arts, University of Toronto, is open for a proposition. Administrative or research work preferred. One year's experience in cotton acid and general work in large laboratory. Present salary, $125 per month. Address: Box 10, THE CANADIAN CHEMICAL JOURNAL.

Experienced chemist desires responsible position. B. Sc. of a British University, F.I.C., and a graduate of a well known technical college ; several years experience in organic research. For over five years have held present position as Chief Chemist to large firm. First-class references. Address Box 4, Canadian Chemical Journal.

A young engineering student desires a position in a chemical laboratory. Complete high school education as well as two years at Toronto University in the department of chemical engineering.—Box 16, CANADIAN CHEMICAL JOURNAL.

POSITIONS OPEN

Industrial concern located three hours from large city, wants immediately a young graduate chemist (man or woman) for analytical work. Must have good experience in routine analysis. Application forwarded to Box 14, THE CANADIAN CHEMICAL JOURNAL. State salary wanted.

CHEMICAL ENGINEERS WANTED

A large corporation about to develop a hydro-chemical process on a large scale requires the services of a technically trained engineer of broad experience, preferably one familiar with the manufacture of soda ash by the ammonia-soda process.

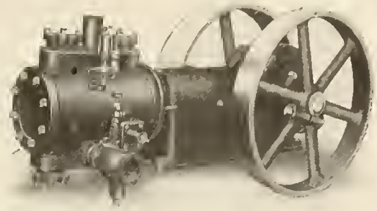
Also

Chemical Engineer, familiar with the design and operation of electric furnaces.

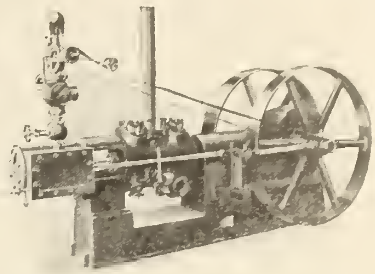
Submit detailed record of training and experience and state salary desired. Send copy only of references. All negotiations will be treated confidentially.

Address Box 20, CANADIAN CHEMICAL JOURNAL.

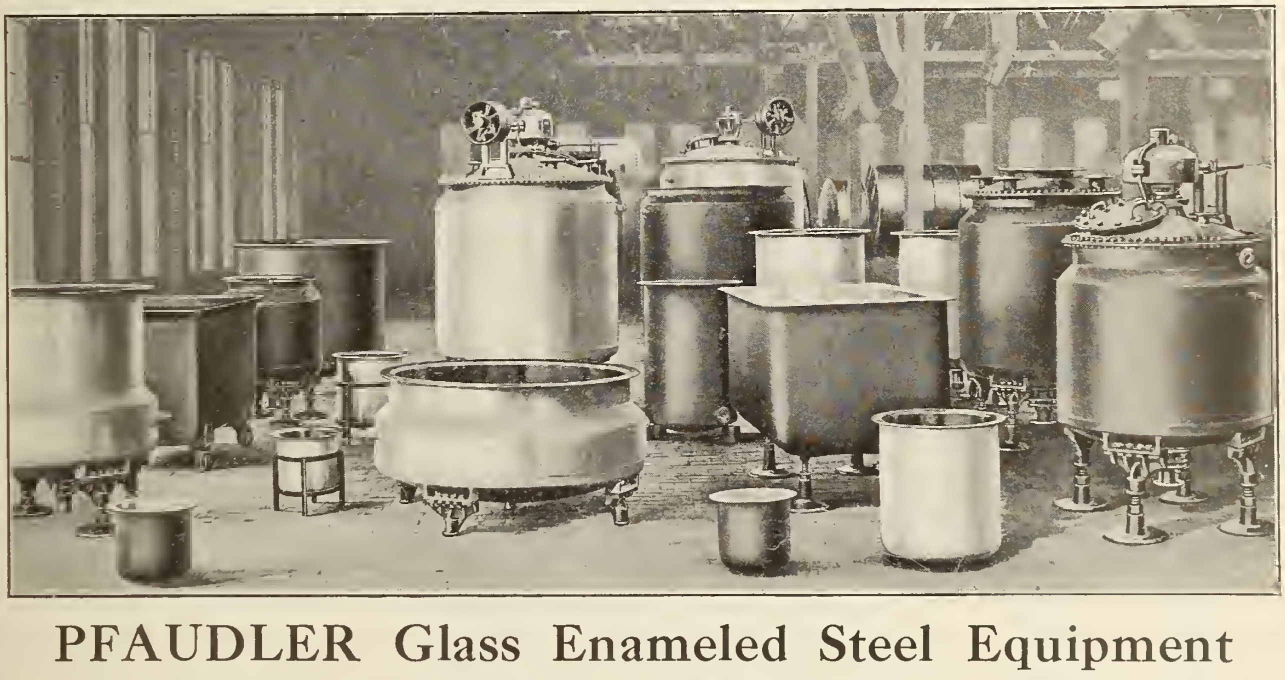
Single Stage Air Compressor, with Short Belt Drive



Single Stage Air Compressor, Power Driven



Single Stage Air Compressor, Steam Driven



Classified Index of Advertisements

Acid-Proof Chemical Stoneware Apparatus

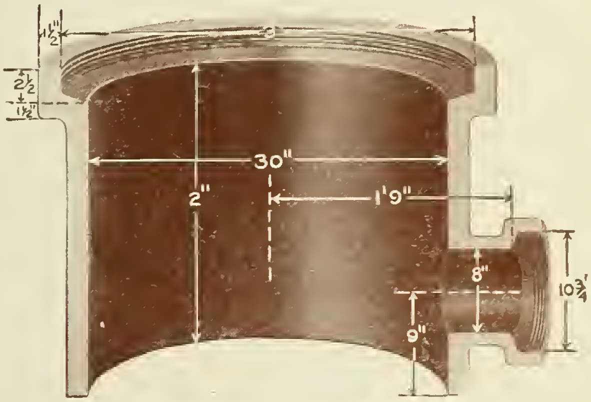
STANDARD or SPECIAL

All guaranteed Acid-Proof Throughout ; Vitrified yet Tough.

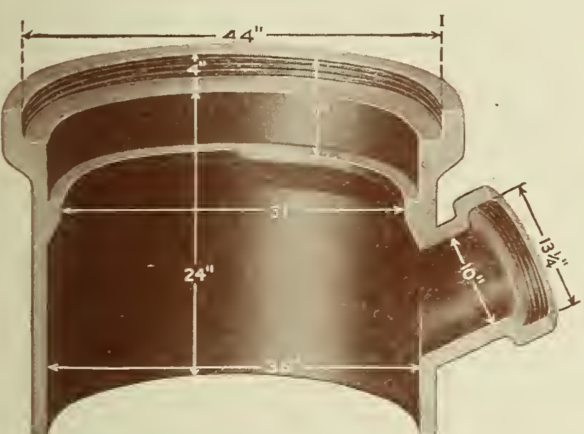
Made in America by Americans who know how.

IT IS THE BODY ITSELF

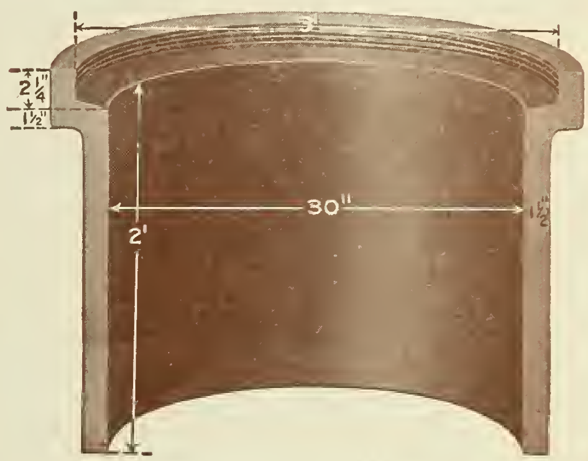
ACID-PROOF TOWER DISTRIBUTOR
Made to fit any size or bore tower from 12″ to 42′



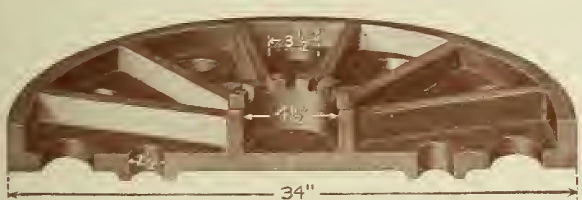
ACID-PROOF TOWER TOP SECTION
Or can be used as inlet bottom section by using cascade



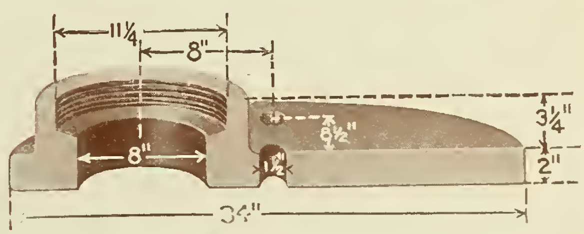
ACID-PROOF TOWER BOTTOM SECTION
Showing 10″ Y and Ring for supporting perforated plate, or as top section for distributing plate.



ACID-PROOF PLAIN TOWER SECTION
Notice heavy grooved sockets. We make tower pipe in any bore from 12″ up to 42″



ACID-PROOF DISTRIBUTING PLATE
Made in many sizes and designs.



ACID-PROOF TOWER COVER
Used with internal distributing plate and doing away with Y or Tee outlet top section.

We carry a large stock of Acid-Proof Brick and other tower packing.

MAURICE A. KNIGHT — Office and Factory Kelley Avenue — **East Akron, Ohio**

CANADIAN CHEMICAL JOURNAL

A Canadian Journal devoted to Metallurgy
Electro-Chemistry and Industrial Chemistry.

Vol. II, No. 5 | TORONTO, MAY, 1918 | 20c. a copy; $2 a year

PROFESSIONAL DIRECTORY

CANADIAN
CHEMICAL JOURNAL
A Canadian Journal devoted to Metallurgy
Electro-Chemistry and Industrial Chemistry.

Vol. 2 TORONTO, MAY, 1918 No. 5

CANADIAN CHEMICAL JOURNAL

DEVOTED TO THE CHEMICAL AND METALLURGICAL INTERESTS OF CANADA.

Published monthly by the Biggar Press Limited

Office, 36 Toronto St., Toronto, Canada

Telephone Main 7399. E. B. BIGGAR, Managing Director

Subscription price, $2.00 per year to Canada, United States and all parts of the British Empire.

Time of going to press, 1st of each month. News and changes of advertisements should be in hand one week before.

NOTICE

The Editorial Department exercises every care to ensure the correctness of the contents of the Journal. It is understood that the authors of signed articles are alone responsible for the statements they may make, whether of fact or opinion. Address all editorial correspondence to 36 Toronto Street.

Principal Contents

Back numbers of the Canadian Chemical Journal are wanted, dating from July to December inclusive. Full price will be paid for copies received with reading matter pages in good condition.

Convention of Chemists

THE general convention of chemists, to be held at Ottawa on the 21st and 22nd of this month, will be important, since it marks the opening of the new era in the progress of chemistry as applied to the growing industries of Canada. Everyone who employs a chemist or uses the products of a chemical works would benefit by attending the convention, or at least by sending a representative. As an esteemed contributor puts it: "Firms as well as individuals should be represented, and every firm should be urged to have their chemist there as a matter of good business more than a courtesy."

The programme and agenda will be found on another page.

A Canadian National Bureau of Standards

EACH year shows the increasing need of a Canadian National Bureau of Standards at Ottawa. We have come to look upon certain industries as "keys" in their general relation to the complete life cycle of the country. A National Bureau of Standards would bear this same relation to our chemical and physical laboratories and to the many industries depending on them for guidance. The functions of such a Bureau would be as diverse as the industries that were served by it. A casual glance at the list of publications of the United States Bureau of Standards is sufficient to convince anyone of the very valuable work their organization has accomplished. Canadian industries have been greatly indebted to this work in many ways, such as: the accurate testing of temperature instruments, volumetric glassware, chemicals, calorimetric standards, the preparation of standard samples of pure materials and mixtures of known composition, the establishment for engineering and chemical purposes of the physical constants of metals and other materials to that high degree of accuracy demanded in modern scientific work, etc.

In the past one institution of this kind on this continent may have completely filled the need. At the same time there is a good opportunity and much work awaiting a Canadian Bureau, dealing purely with Canadian problems, at the present time. As

long as we remained buying nearly 50,000 miner's safety lamp glasses from Germany and Austria per annum we accepted the foreign testing. The work of our own glass manufacturers in attempting to place an article of this kind on our own market or on any foreign market should be backed up by the stimulating co-operation of a wide awake scientific Government. In general, if we are to attempt to enter into that rich field covering the manufacture and export of scientific materials, the Government must control and back up these products with the guarantee of a Canadian National Bureau of Standards.

Encouraging Research

THE Advisory Council for Scientific and Industrial Research have taken a step which we believe will greatly encourage investigations into industrial problems of national importance. A committee of three members of the Council has been appointed to consider and decide upon applications from those who wish to pursue investigations but may not have facilities for the work.

One commendable feature of this move is that the grants will not be confined to university men, but are open to all engaged in research under the conditions stated in the Council's announcement.

The grants of money will, as a rule, be made only to those conducting investigations in established laboratories, and will not be made for the purchase of standard apparatus which a well equipped laboratory ought to possess. The grants are to be for one year only, and to those who can show capacity for independent research, and reports of progress are also to be made annually Where special apparatus is purchased for the purpose of these grants such apparatus will be regarded as the property of the Advisory Council, and to be surrendered when the investigation is concluded. The grantee will render an itemized account of his or her expenditure and unexpended balances handed back at the close of investigations. Grants are to be made for the purpose and work of the investigation and not for the maintenance of the grantee or for the payment of assistants. Each applicant must give a brief statement of the proposed investigation, its scope, the time required, results hoped for; the estimated total cost and the specific purpose to which the grant will be put; and if the applicant is receiving, or has applied for a grant from another body that fact must be stated. Finally the first publication of the results of the investigation shall rest with the Council, though the grantee may afterwards publish the results of his research, with acknowledgments to the Council.

Further particulars may be obtained from the Council, whose headquarters are in the Department of Trade and Commerce, Ottawa.

Editorial Distillates

THE Tanners Section of the Canadian Manufacturers Association have arranged to cooperate with the Advisory Council on the possibilities of applying modern methods of scientific research to the improvement of the Canadian tanning trade.

THE Commission of Conservation will shortly undertake an investigation into the water powers of New Brunswick that are capable of developing any considerable power. The recent coal shortage has awakened the province to the fact that its water powers are not being adequately utilized.

THE system of chemical shorthand briefly outlined in this issue by the author, a chemist resident in California, is novel and ingenious. As the chemical processes develop and compounds and alloys become more complex the need of a simpler and more flexible system of symbols will be manifest, and this appears to be the first essay to anticipate the need.

THE establishment at Shawinigan Falls of an electrolytic process for recovering metallic magnesium from magnesite has stimulated the production of this metal. Magnesium is used in connection with the war for the manufacture of star shells, flares and other types of illuminants. It is also used as an alloy with alluminum for the manufacture of aeroplane parts.

A REAL step in advance was made in the practical solution of our domestic fuel problems when the Government recently informed the Advisory Council for Scientific and Industrial Research that they had provided $400,000 for experimental work. A plant is to be established and operations started on the lignites of Eastern Saskatchewan. The Dominion Government is acting in cooperation with the provinces of Saskatchewan and Manitoba. Immediate steps have been taken to develop the peat bogs of Ontario. R. A. Ross, C.E., a member of the Advisory Council, has been chosen by the Ontario Government to cooperate with Arthur Cole, C.E., in this connection. The work of investigation will be proceeded with at once in Northern Ontario.

IT is satisfactory to learn that the Government is seriously considering the adoption of the only practical method of using the large quantities of alcohol in bond and distributed throughout this country. Although a theoretical loss must be shown on the books a practical gain is accomplished when this product is diverted to its real purpose—munitions. This clears the air at once in one direct move. The conversion of alcoholic liquors into industrial alcohol is another and more difficult problem. There are large stocks of whiskey, etc., some of which has been "aged" till it is worth commercially from $4 to

$10 a gallon. A quart of distilled whiskey will contain half a pound of pure alcohol, and ethyl alcohol is sold as low as ten cents a pound. Again the difficulty in exporting the liquor as whiskey is to find a market, for the cost of cultivating a new market is very high. If the new law is carried out as proclaimed, there will be a heavy loss to the holders of whiskey. The Government has not announced its method of dealing with this problem.

IT has taken the United States Government just one year to commandeer the available supply of platinum in the country. With Orders in Council coming into their own in the way they have been in Ottawa recently is it too much to ask the Canadian Government to follow the action of the American Government in this matter? Every chemist knows the vital necessity of conserving and properly using our scanty store of this king of all metals, but many people still remain who consider it only a rapid way of spending money. As an organization, the chemists of the United States have advocated government control of the metal, but the jewellery interests, after first agreeing to discourage the use of platinum for personal adornment, turned against the "selfish chemical interests" on the ground that they were "bearing" the price in order to make platinum cheaper. Various patriotic societies then came to the support of the chemists, condemning the use of platinum jewellery, and it became evident that the jewellery trades were likely to become victims of the speculator. The Government settled the controversy by taking control and fixing the price at $105 an ounce. Platinum gauze is a necessity in the fixation of atmospheric nitrogen and since the metal is the most resistant of all chemical reagents and is used in all processes, the coming convention of chemists at Ottawa may well discuss the position in Canada.

Alcohol From Wood Waste.*

By Geo. H. Tomlinson

The close similarity between cellulose and starch was discovered long ago and various attempts have been made to bring about the conversion of cellulose into glucose. As early as 1837 it was announced that this had been accomplished by boiling cotton in concentrated sulphuric acid, but the matter remained for many years one of purely scientific interest. In the late nineties, however, serious efforts began which have since resulted in commercial results along this line being obtained. About this time two chemists, Simonsen in Norway, and Classen in Germany, showed that on treating sawdust with very dilute acids even as little as one-half of one per cent. and heating under a steam pressure of several atmospheres, 15 to 20 per cent. of the wood was converted into glucose. On account of the very small acid consumption involved, and other favorable factors, it seemed that a commercial process had at last been disclosed, particularly so in the case of the process proposed by Classen. Theoretically this was true, and exceptionally good results were obtained in a small demonstrating plant which was set up in Chicago about 1903. On attempting, however, to translate these results into commercial practice, complete failure was the result, since two large plants each costing several hundred thousand dollars to build were abandoned.

In 1904 I began to apply myself seriously to the solution of this same problem. In view of the results already obtained by Simonsen and more especially by Classen, I came to the conclusion that its successful solution would likely prove entirely a matter of engineering skill. It was quite evident from what had already been done that a certain part of the wood was easily convertible into glucose, while to increase this yield seemed not only difficult but to involve a cost for reagents out of all proportion to the cost of the raw material involved. Comminuted wood or sawdust is an extremely bulky material and in view of all the factors commercial success apparently hinged on finding means by which it could be processed with sufficient speed and yet leave the material in such condition that the sugars thus formed could then be separated and recovered from the great mass of residue.

Several years of preliminary work on a large scale proved that both of these results could be obtained by conducting Classen's process under slightly modified conditions in apparatus of a more practical design than he had employed and adapting principles thoroughly established in other industries to meet the requirements in question.

Construction of the first commercial plant was commenced at Georgetown, South Carolina, in the autumn of 1909. This plant costing $200,000 was completed the following summer and since then has been operating almost continuously, producing as much as 2,000 gallons of alcohol per day from sawdust and other lumber refuse coming from the great mills of the Atlantic Coast Lumber Corporation.

In 1911 it was taken over by the Dupont de Nemours Powder Company, by whom it is still owned and controlled.

In 1912 a much larger plant was commenced at Fullerton, Ia., which was substantially completed the following year. Financial breakers, the result of too much high finance, and costly promotion, were met, however, before a start was more than made and since then the property has been drifting through a receivership and other vicissitudes which led to my severing my connection with the business.

As a result of reorganization some of these difficulties have since been overcome at the expense of the original investors and the plant has now been operating continuously for over a year with an output of about 3,000 gallons per day and handsome profit. While I have no exact figures on present costs, I understand that they are about the same as those which I obtained in 1913. If this is the case their alcohol is being produced for something between 30 and 35 cents per gallon, or less than half its present cost of production from grain. The combined output of these two plants, which is, I believe, all being used in the manufacture of smokeless powder would if produced from grain require considerably more than half a million bushels per annum, which represents an appreciable saving, the principal credit for which I feel I can quite modestly claim, having designed and constructed both. This process in its present form divides itself into several distinct steps.

Sawmill refuse, which constitutes the most available raw material is made up of slabs, edgings, trimmings, bark and sawdust, all of which must be taken as it comes and be reduced to a uniform condition. This is done by means of suitable grinding and screening machinery and constitutes much the same problem as the preparation of wood in making sulphite pulp, except that the grinding is finer and the bark is not removed. At Fullerton, Ia., the mills of the Gulf Lumber Company cut about 300,000 board feet of lumber per day, yielding some 600 to 700 tons of refuse of all kinds. In order to permit of the maximum possible amount of this being available for alcohol production a central power plant was provided and in this the 5,000 horse power which the two plants use is generated from the residue left after

* From an address before the Board of Trade of Niagara Falls, Ont.

the sugar is extracted and which constitutes 70% of the original material. Having prepared the raw material the next step is its conversion into sugar. This is carried on in large rotary digestors lined with tile and having a capacity of 10 tons at a charge. In the Fullerton plant there are six of these so arranged that they can be filled and emptied with the least possible delay. 1% of sulphuric acid, as a 10% solution, is sprayed over the charge of sawdust and it is then heated by the direct introduction of steam to a temperature of 275 degrees F. or thereabouts. This temperature is held for about one hour, the pressure is then reduced and the contents of the digester discharged. In all, the process consumes from two to three hours for each charge, including the time of filling, heating up and emptying.

When removed from the digester the material contains 55% moisture, 8% to 10% sugars and the balance consists mostly of the insoluble woody residue. This is then passed on to a diffusion battery of exactly the same general design as that used in extracting sugar from beets and from this a clear solution containing about 10% of sugar is obtained and the woody residue removed.

In the plants to which I have referred there is, of course, a completely equipped distillery for carrying this sugar solution through the steps of fermentation, distillation, etc., and yielding as a final product the highest possible grade of ethyl alcohol or Cologne spirit as it is usually called. As auxiliary steps there is the drying of the woody residue which serves as fuel in generating all of the steam and power required in the conduct of these various operations, there is the recovery of turpentine as a by-product, the manufacture of yeast, cooperage, etc., all involving their separate problems, and thus constituting a fairly complex industry considered as a whole.

While from the mechanical point of view these two plants may be termed a great success, in that the different steps and operations proceed smoothly, efficiently and satisfactorily, nevertheless the yields in alcohol have been disappointingly small, amounting to only 50% of that anticipated. In the laboratory there was no difficulty in converting 20% of the wood or even a little more into fermentable sugar in a number of different ways, but on applying the same treatment on the large scale, while the total amount of sugar formed was the same, only about half of this could be made to ferment. This was an extremely puzzling problem and although an enormous amount of research has been directed towards its solution by the organizations that have more recently been engaged in the development, I may say that no substantial improvement has been effected. My own more recent study has led to certain conclusions embodied in my Canadian Patent No. 182387 issued in February last. Through the introduction of a simple step which this patent discloses, it is now possible to duplicate on the largest scale the results heretofore confined to laboratory operations alone.

While my original idea that the problem was purely one of engineering has been largely confirmed, nevertheless it has required prolonged chemical research to develop its present possibilities, as well as to bring about the translation of the various theoretical consideration into commercial practise. The development has been further complicated for the reason that to avoid patent infringment sulphuric acid has been used as the reagent, whereas sulphurous acid can be more easily and efficiently employed as Classen originally showed. This is a condition, however, which through the lapse of time no longer need apply.

I have already referred to the cost of producing alcohol from sawdust as amounting to something over thirty cents per gallon.

Under present abnormal conditions the advantages are enormously in favor of its manufacture from sawdust even on the basis of the present low yield, since sawdust is one of the few products which has not increased in value, whereas the cost of grain has more than doubled. In view, however, of the much larger yield, which I claim can now be obtained, a cost of twenty cents per gallon of alcohol is well within the range of expectation and when this cost is reached, as I feel sure it will be, the application of alcohol in industry will receive a big advance. It may be expected to compete with gasoline for fuel purposes and motor cars. It is looked upon as the ideal source of power. Safety, cleanliness and reliability are greatly in its favor while in a properly designed engine its efficiency also favorably compares.

In the manufacture of fine chemicals such as drugs, dyes, etc., Germany has been pre-eminent and her control of this trade was to a large degree dependent upon the cheap production of alcohol from potatoes, an industry which was encouraged in every possible way. Then we have such products as celluloid, which can only be made through the solvent power of alcohol or ether, of which the latter is derived, as well as collodion which finds such an extensive use in our photographic industry in the production of films. Shellac and lacquer are both products which we use in numberless directions, and in making which alcohol is the solvent used.

The manufacture of artificial silk and artificial leather, both new industries capable of enormous development yet almost unknown here, can only exist where cheap alcohol can be obtained.

When we come to war essentials, we find that in the production of every pound of smokeless powder, 1.4 pound of alcohol is required, while in the manufacture of fulminate of mercury, which is the indispensible constituent of percussion caps, for every pound produced nine pounds of alcohol is used. If then, we are to develop a full grown chemical industry in Canada, and we already realize the importance of such in creating national independence, we must encourage in every way the manufacture and use of alcohol for industrial purposes since into almost every manufactured article which we use it enters at some stage of production.

The sugar solution obtained on diffusing the converted sawdust has a slightly acid taste, but on adding lime, the acid is neutralized and the solution assumes a somewhat darker but not unpleasant, sweetish taste.. If it is then concentrated by evaporating under a vacuum, a product quite similar to ordinary cane molasses is obtained and of corresponding food value.

This can be mixed with alfalfa, hay, etc., for cattle feeding or even with the woody residue from the process itself, since this has now been reduced to a pulpy consistency, and in this condition is quite suitable to furnish the necessary rubbage in a fodder. From a ton of dry sawdust 50 gallons of such molasses can be made and assuming 50 cents per ton the cost of sawdust this product can be produced for less than 4 cents per gallon, including all overhead and manufacturing expense and this I believe represents the cheapest source of carbohydrates at present known. Cane molasses at 15 cents per gallon is considered cheap and desirable feed and is being used to-day, although its price has advanced as high as 30 cents per gallon. In the South where cane molasses is in general use for feeding it is claimed that it greatly improves the condition of the stock.

While the corresponding product made from wood has not been subjected to exhaustive feeding tests, it has been tried out sufficiently to know that it is acceptable to animals, produces no baneful results, and can apparently be substituted for a corresponding percentage of carbohydrates in the usual ration without any complications or difficulty.

The lumber industry in Canada ranks third in its commercial importance, if we eliminate manufactured goods as a class, being exceeded only by our field crops and our animal products. For the last year our lumber trade in round figures amounted to $175,000,000. The lumber industry, however, is the most wasteful of all industries.

It is safe to say that for every foot of lumber cut from the log, its equivalent weight is rejected in one form or another. Thus a mill cutting 300,000 feet of lumber per day will produce its equivalent weight in residues or approximately 700 tons.

A portion of this may be used for making laths, shingles, box shooks, etc., and some for fuel, but even then a larger percentage is left to be destroyed in the huge incinerator which forms a part of every saw mill.

I have been told that the amount of lumber waste destroyed by the coast mills in British Columbia amounts to approximately 10,000 tons per day. If this is the case, and all of it could be converted into molasses, we have on the basis of 50 gallons per ton, assuming a 50% moisture content, an available output of 250,000 gallons per day, or if converted into alcohol, an output of 125,000 gallons per day.

If this quantity of alcohol were produced it would supply our Allies their present requirements for the production of smokeless powder and fulminate, or again it would be sufficient to operate our 200,000 motor cars, still leaving a balance for other industrial use. On the other hand, if it were all converted into molasses and used for cattle food it could be made to take the place of approximately 15,000,000 bushels of grain per annum in making up our animal dietary.

Cellulose is still a mystery, and in no field of chemistry is there such opportunity for further research and development. While its industrial applications are already manifold it still remains, on account of the complexity of its molecule, practically an unexplored domain, and such knowledge as we have is purely empirical.

Produced as it is from sunlight and air, in reality nothing more than solar energy in another form, it represents nature's inexhaustible storehouse, upon which we are free to draw whenever we unlock the door—we are already indebted to it for the coal which keeps our houses warm and for the apparel which protects our persons and retards the radiation of bodily warmth. Is it not possible, therefore, that while its nitration products are blasting the way to peace, the application of its stored energy points a way for mitigating the suffering which the world seems called upon to face.

Society of Chemical Industry

Annual Meeting of Canadian Section and Convention of Canadian Chemists.

To be Held in Ottawa, May 21st and 22nd, 1918.

Programme of Proceedings—

Tuesday, May 21st

9.00 a.m. to 10.00 a.m.—
Registration.

10.00 a.m. to noon—
Parties will be made up to visit the following places: The Mint; Laboratories of The Mines Branch, Bureau of Mines; Laboratories of Fuel Testing Station; Laboratories of Inland Revenue Department; Laboratories of the Corporation of the City of Ottawa.

1.00 p.m.—
Luncheon.

2.30 p.m.—
Visit to the plant of the E. B. Eddy Company, Hull.

5.00 p.m.—
Afternoon tea, Chateau Laurier, with the ladies.

8.00 p.m.—
Discussion on Organization.
Chemical Research in Relation to Agriculture.
As this is a matter of vital concern to all Canadian chemists a profitable discussion is to be assured.

8.00 p.m.—
Ladies—Theatre party or public lecture by Professor Mackenzie, of Dalhousie University, Halifax.

Wednesday, May 22nd

10.00 a.m. to noon—
(a) Association of Canadian Chemists—Prof. Parker.
(b) The present status of the industry of Ethyl Alcohol from wood waste—Mr. Tomlinson.
(c) Examination of Commercial Dextrines—Mr. Babington, Dr. Tingle and Mr. Watson.
(d) Standardization of Benzine and Gasoline—Dr. A. McGill and Mr. W. A. P. Schorman.

2.30 p.m.—
Conjointly with Royal Society by invitation.
Recovery of Liquid Oils from Gases and new methods of Estimation of Vapors in Gases—Dr. H. S. Davis.
Adoption of Standard Method for Estimating Moisture in Wheat—Dr. J. T. Birchard.

8.00 p.m.—
Annual Dinner, Society of Chemical Industry.
(a) Election of Officers and other business.
(b) Addresses from Chemical Industrialists.
(c) The chairman elect.

8.00 p.m.—
Ladies—Public Lecture—"Relation of Theory of Sound to Art of Music," by Mr. Dana C. Miller.

Thursday, May 23rd

10.00 a.m.—
Visit to the Experimental Farm.

1.00 p.m.—
Joint Luncheon with the Royal Society.

Finis

N.B.—Rooms may be booked in advance at the following hotels: Chateau Laurier, Russell House, Victoria Chambers; and no difficulty is anticipated in procuring accommodation, as the sessions ends probably not later than May 10th. A final programme will be sent to those intimating their intention of being present. ALFRED BURTON, Convenor.
Hon. Secretary, Canadian Section, Society of Chemical Industry.
Explosives Dept., Imperial Munitions Board, Ottawa.

AGENDA

(a) An election to fill the vacancies caused by the retirement of five members of the Committee.

(b) Adoption of the following amendments to the rules of the Section.

Rule 2. To delete "two of whom shall be chosen as vice-chairmen by the committee" from lines three and four.

Rule 4. To delete "ten" in line four.

Rule 14. To delete the whole and substitute the following. "In centres where meetings of the Section may, at various times be held, the executive may sanction the appointment of local committees and local chairmen and secretaries who shall be nominated and elected by the members residing in that centre; such committees shall report through their secretaries to the executive, and local chairmen shall be ex officio members of executive."

Proposed New Rule 16. "The local committees, formed under Rule 14, may levy a fee, not to exceed $5.00, on those desirous of becoming members of the local branch, who shall satisfy the committee of their claims and status as a chemist; such fees shall be at the disposition of the local branch collecting the same. This shall not entitle the member to the Journal of the Society but shall entitle him to vote and all the privileges of the local branch.

(c) The transaction of any other business that may be brought before the meeting.

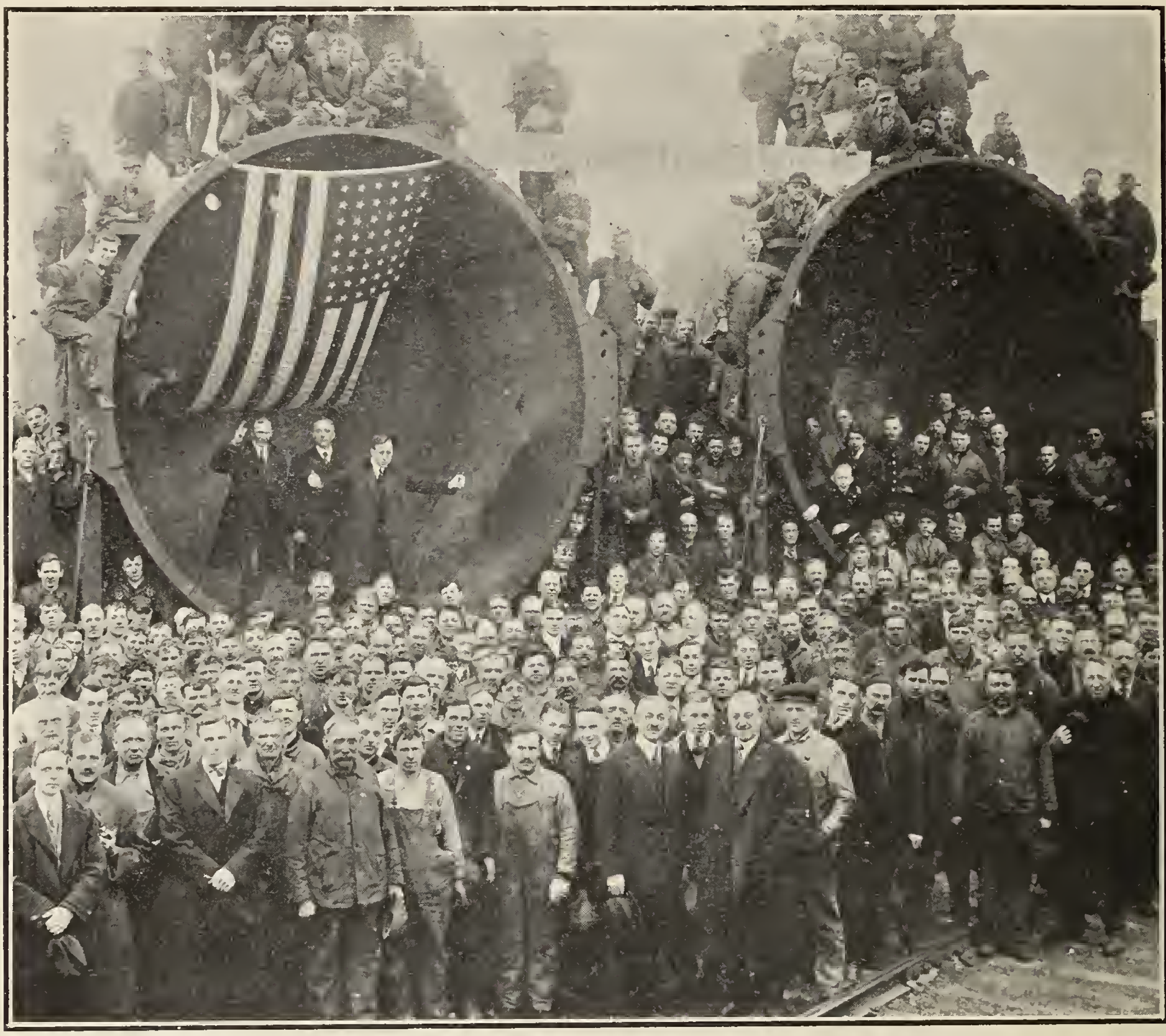
Delegates and visitors will oblige by informing the honorary secretary of their intention to be present.

Chemical Industries in "The Liberty Loan"

A representative of The Canadian Chemical Journal on a recent trip to a number of American cities found a remarkable enthusiasm for the prosecution of the war. Innumerable meetings have been held in behalf of the new "Liberty Loan," and many of these are organized by the employees of firms and companies on their own account. The chemical industries were prominent in these demonstrations.

A typical instance of this enthusiasm is here illustrated from Buffalo, where the men of the Buffalo Foundry and Machine Company, the well known makers of chemical equipment, organized a meeting on the 24th April, when a gathering of three hundred were addressed by Mr. Christopher G. Grauer and Mr. F. A. Olzanowski, who spoke in English and Polish. They dwelt on the necessity of supporting the men on the firing line with every available means, and met with a hearty response. It is only natural that so much enthusiasm should be shown by these men as almost the entire present output of this plant is for United States Government requirements.

The photograph which was taken at the close of the meeting shows a portion of the employees standing beside a car loaded for shipment, containing two large pieces of apparatus to be being erected by the Government in the Southern States. Many of such castings will be required. An interesting feature of this work is the extraordinary measures that were required to insure transportation of this apparatus from Buffalo to the point of erection. Owing to the great size of the castings it was necessary to move the cars over a carefully established route in order used in the construction of one of the enormous nitrate plants to obtain sufficient overhead clearance, in some places certain tracks and switches being specified to avoid bridges or other obstructions. As a special precaution, the railroad has a representative accompany each shipment to guard against the possibility of anything going wrong, and everyone having anything to do with the handling of the apparatus while enroute was kept fully advised of the movement of the cars.



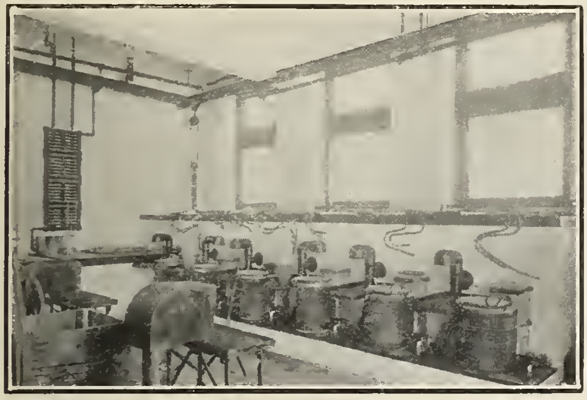
Liberty Loan Address to Buffalo Foundry and Machine Co. Employes.

A fire last month caused damage to the amount of about $50,000 to the premises of the Chemical Products Co. in Toronto. Quantities of chemicals, difficult to replace in war conditions, were destroyed, but fortunately the manufacturing plant was but little damaged and the proprietors are energetically working to replace the lost materials.

Miller's Chlorine Process in Minting

By Ralph Pearson, Chief Assayer, Royal Mint, Ottawa

The first use of chlorine gas for the purpose of refining alloyed gold appears to have been made by Lewis Thompson and dates back to the year 1838, when we are told he was presented by the Society of Arts of London with the sum of twenty guineas, and his paper on the subject was published in their transactions. In 1867, F. B. Miller, assayer to the Sydney (Australia) branch of the Royal Mint, obtained a patent for an "improved method of toughening brittle gold, of refining alloyed gold and of separating therefrom, any silver they may contain." I think from my knowledge of Miller's contemporaries, that there is no question that he arrived at his conclusions and obtained all his data without knowledge of Thompson's work thirty years before. I think he is undoubtedly the one to whom credit is due for first applying the process on an industrial scale.



Furnaces, Chlorine pots and pipe stems. In front, hoods connected to fan and overlapping pouring tables.

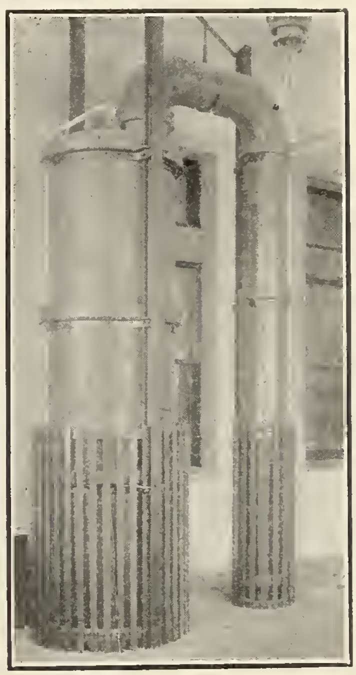
The Chlorine Process is one peculiarly adapted to the rapid refining of what is called Rough Gold, that is gold alloyed with varying proportions of silver and base metals. The base metals include everything in the metallurgical calendar, and the proportion varies from 99% gold, 1% silver and base, to 1% gold and 99% silver and base. The average composition in Victoria, Australia, is 91.42% gold, 4.34% silver, 4.24% base. The composition of 108,000 ounces Yukon gold, received at the Ottawa Mint during 1913, was gold, 76.77%; silver, 19.8%, and base, 3.43%.

The amount of base metal contained in a rough gold ingot largely depends on the care and skill of the melter at the mine where the gold is produced. Two neighboring mines, working on ore of approximately the same composition, will produce ingots varying widely in their contents of base metal. The one has possibly 75% gold and silver, and 25% base, the base consisting of 15% lead and 10% copper and arsenic. For the removal of large quantities of base, the Mint charges an additional fee. The other melter by the simple use of nitre or any other convenient means, sends out an ingot containing, say 5% base, this saving the mine owners many dollars in charges for additional treatment before a reliable assay is obtainable.

The refinery at the Ottawa branch of the Royal Mint began work in January, 1911, the equipment being entirely for the electrolytic deposition of gold and silver. The capacity of this equipment was soon found to be quite unequal to the supply of rough gold sent from all parts of the Dominion and beyond. The Government was at first informed that no Yukon gold would be sent to Ottawa, and yet the refinery has treated Yukon gold alone to the value of $57,250,000. The Porcupine district introduced a new contributor; the gold of Ontario origin received at the Mint in 1912 had a value of $196,000, and, in 1913, over $1,500,000, it was therefore decided that as the first part of the electrolytic process, viz.: the plating out of the silver contents required a very considerable part of the time available, it would be advisable to replace this by the Miller Chlorine Process, and the existing building was extended to accomodate the equipment for this.

The equipment of the Miller process is comparatively simple and is as follows: A constant supply of chlorine gas at a pressure of not less than five pounds to six pounds per square inch, melting furnaces, either coke or oil, condensing chambers at rear of furnaces, and suitable pots, tongs and moulds.

At the Ottawa Mint the chlorine gas is delivered to the furnaces from steel cylinders, each holding 100 pounds liquid chlorine at a pressure of 97 pounds per square inch, at 20°C. The cylinders are in a brick cupboard having a tightly fitting door and ventilating pipe passing to the furnace flue, and also a pipe communicating with the outside air, so that there can be a constant circulation and any accidental escape from the cylinders would not find its way into the building. Two cylinders are used, connected by a common header to duplicate half inch, nine pound lead pipes, and so arranged that either cylinder may be used on either pipe line by simply opening and closing the necessary valves. The lead pipes are carried to points immediately above the furnaces where metal control valves are inserted for regulating the supply of gas and are connected with the lead by flanged metal couplings. Two branch pipes are connected with a lead receptacle having three necks similar to a Woolff's bottle, the third neck holding a lead pipe connected to a glass tube which is in turn attached to a lead bulb, very similar to an enlarged pipette. The lead vessel holds sufficient water to give a column eleven feet in height, corresponding to a working pressure of about five pounds per square inch. Should the pressure exceed this owing to suddenly shutting off the supply to several furnaces, then the water is forced into the lead bulb and the gas would escape outside the building, thus preventing any danger of bursting the rubber connections or blowing the liquid metal out of the crucible.



Washing tower and pipe to exhaust fan in basement.

The furnaces are fire clay cylinders 18 inches high, 14 inches diameter, encased in sheet iron and having an inlet at the bottom for the atomized oil and air, and a small outlet, 3½ inches in length, 2 inches wide, placed 2 inches below the top for escape of products of combustion, etc., the interior is cylindrical, 15 inches deep, 8½ inches diameter. The furnace covers are fireclay made in two parts, having a one inch hole in centre to allow

passage of the earthenware chlorine pipe. These furnaces burn crude oil fuel, 86 Sp. gr. at a pressure of 40 to 50 pounds per square inch and air at two pounds per square inch.

The flame enters at a tangent and whirls around in the form of a spiral, finally reaching the outlet at the top, which is connected by a short flue, nine inches long with the condensing chamber $5' \times 4' \times 20'$ in length. This in turn is connected with a similar chamber running at right angles to the first one, also 20 feet long, by 3 feet 6 inches wide by 3 feet high. From the end of this chamber the flue is carried to the foot of washing tower, 20 feet high and 30 inches diameter, and having a water spray attached to the centre of the top piece. This tower is connected with a 12 inch earthenware exhaust fan, driven by a 7½ horse power motor at 1,000 R.P.M., propelling 4,400 cubic feet of air per minute. The bottom section of the tower standing in an earthenware tank to collect any material washed from the fumes by the water spray. The fumes resulting from the chlorination and all furnace gases are thus immediately drawn from the furnaces through the chambers, and pass up the washing tower against a spray of water before being blown out the chimney.

The crucibles are known as four pint chlorine pots and are made of clay, the outside measurements being: Height, 11¼ inches; diameter, 5¾ inches, tapering at the bottom to 3¼ inches; walls, ⅜ inches. For the first round 500 to 700 ounces of the metal to be refined, (together with sufficient borax to form a layer ¾ inches deep on the fused metal) are melted in the clay crucible, standing in a plumbago guard pot to catch any leakage due to a defective crucible or an accident. After the first charge is refined the pots are recharged with the necessary quantity of crude bullion from a conveniently situated supply pot in which 3,000 ounces are kept ready melted, the passage of the gas is thus almost continuous, being interrupted only during the time required to clean the surface and pour the fine gold. The clay crucible is covered by a clay lid having a slot for the passage of the clay pipe stem. These stems are made of white clay and are 25 inches long, ½ inch diameter, ⅛ inch bore and connected with end of lead supply pipe by a flexible rubber joint. When the metal and borax are melted the pipe stem previously heated to redness is introduced through

Interior of Addition, showing chlorination furnaces and ventilating fans, immediately before commencing work.

the slot in the lid, pushed to the bottom of the crucible and held in position by a clamp. The chlorine is slowly admitted by cautiously opening the valve controlling the supply to that particular furnace, until the gas is passing through the metal with a steady pulsation. As lead and copper are nearly always present dense fumes of chlorides of these metals immediately appear and practically the whole of the chlorine is absorbed. As the action continues silver chloride is formed and floats on the top of the gold together with some copper chloride beneath the layer of borax. During the process all base metals are converted into chlorides and expelled, finally leaving the gold, the fused silver chloride and the borax cover. The finishing point is judged by the brown stain formed on a piece of cold pipe stem held in the fumes issuing from the pot; and workmen become very expert in judging the finishing point by the color of the flame. When it is considered that chlorination is complete the flow of gas is stopped, the furnace opened and silver chloride on the surface of the fine gold is baled out by means of a small clay crucible, the surface being finally cleaned by a little bone ash. The fine gold, approximately 600 ounces, is now poured

View of Interior of Addition, showing chlorination furnaces on right and tilting furnaces on left.

into an ingot mould, the chlorine pot immediately receives a fresh charge of crude bullion and the refining process repeated. This may be done as often as five times with one pot, an average with reasonably clean bullion being three. The ingot is quenched, cleaned and twenty-four are melted together in a tilting furnace, each charge being 12,000 ounces. This is thoroughly stirred and cast into bars of 500 ounces, 8½ inches long, 4 inches wide and 1¾ inches deep, the average assay being 995.0. Gold refined in this manner is quite tough, the difference between 9,950-1,000 being silver and a little copper. If gold of higher fineness is required, it is easily and rapidly produced by the usual Wohlwill electrolytic process, the chlorinated gold being used for the anodes. By this means the fineness may be raised to 999.7-999.9. (Note.—Recent experiments have been undertaken to decide if gold 999.0 or over can be economically produced by chlorination, the results were encouraging the highest fineness obtained being 999.6).

The combination of chlorination and Wohlwill's processes has many advantages over the all-electrolytic process.

1. By combining them the loss of interest on large sums locked up during refining operations is greatly reduced:

All-electrolytic—Time required for refining operations, 227 hours
Combined " " " " 56.75"

a difference of seven additional days on which interest would be chargeable.

2. The electrolyte does not become "foul," the base metals having been removed by chlorination.

3. When the work is done entirely by electrolytic methods, the anodes for the Wohlwill process produced from "Black Gold," i.e., the spongy alloy left after the plating out of the silver in a solution of argentic nitrate and nitric acid, contains 94% gold and 6% silver and base, the silver forming large quantities of "slimes," and the removal and treatment of these slimes necessitates extra labor. By the use of finer anodes resulting from chlorination the slimes are materially reduced, gold of high degree of fineness is produced and any traces of platinum are still recoverable from the electrolyte.

It may perhaps be thought that the treatment of the slimes mentioned above is offset by the recovery of silver from the fused silver chloride resulting from chlorination, but such is

not the case, the labor and material used in handling it being very much less than is required for an equivalent amount of slimes.

The time required for a chlorination is, of course, entirely dependent on the amount of metal to be removed; for instance, an ingot weighing 500 ounces and containing 140 ounces base, chiefly lead, and 80 ounces silver, required six hours. When a large quantity of silver is present it is necessary to "dip" the fused silver chloride out with a small crucible, otherwise it would overflow. The silver chloride contains some gold which is removed in the following manner. The cakes are broken up and melted in Number 40 plumbago crucibles, and kept at a temperature a little above the melting point of silver, and an amount of sodium carbonate equal to 10% of the weight of chloride is thrown slowly on to the surface. This produces a shower of silver globules which collect the particles of gold and sink to the bottom. A second addition is made after a few minutes and the resulting shower of globules allowed to settle. It then stands five or ten minutes, and the pot is withdrawn from the furnace, cooled below the melting point of silver and the still liquid silver chloride is cast into cakes 12×12×2 inches. At the bottom of the pot is a large silver button containing all the gold.

Forty-eight cakes of gold-free silver chloride are now placed in a wooden tank, 4×2×2 feet, and having a compartment with a perforated wall at one end containing iron plates, the cakes are boiled in water by means of steam, the copper chloride being dissolved and reduced to metallic copper by the iron plates, the silver remaining free from any copper contamination. When freed from copper the silver chloride cakes are reduced to metallic silver, washed, melted and cast into bars, the whole operation requiring about ninety hours. The tank space required for the treatment of silver chloride resulting from chlorination of one million ounces rough gold monthly is 12×4 feet, i.e., five tanks 4×2×2 feet. The silver produced is 999.0 and over.

On account of the war a temporary addition was made to the refinery in 1916, which has a capacity of 250,000 ounces fine gold per week. In this extension rough gold has been refined to a value of more than three hundred million dollars, the daily output being one million dollars in fine gold bars, the working day being sixteen hours.

Bakers and the Bread Question

Mr. A. J. Banks, F.C.S., chemist of the Ogilvie Flour Mills Company, whose article to this Journal on the chemistry of bread will be remembered, writes advocating the compulsory wrapping of bread, for the same reason that care is taken to ensure the sanitary conditions of milk, meat and water.

"Bread delivery men," says Mr. Banks, "are not required to hold a diploma of an Institute of Hygiene; they are not expected to be conversant with such conditions as contribute to the spreading of disease by infection or contagion. The loaf that dropped from the van and rolled a space of two or three feet along the dusty roadway may appear to be as clean and sound as that which had not shared the same fate; but neither of such loaves could be regarded as being as free from contamination by pathogenic germs as the loaf protected by an efficient wrapper before it was removed from the sanitary surroundings of the bakeshop. The semi-gummy or dextrinous condition of the crust of the loaf aids in the formation of a nidus satisfactory to the ready accumulation of microbial germs. I have devoted many years to the methods of isolation and examination of bacteria and mould fungi, and I have a practical acquaintance with the extreme difficulties of ensuring culture media freedom from accidental infection. Foodstuffs usually consumed in the state in which they are purchased, and are in consequence not submitted to any further sterilizing influence should receive particular care in delivery; and, therefore, irrespective of cost, the delivery of bread in a protective covering or wrapped condition should be made compulsory."

Nicu Steel and Its Manufacture

(From a paper read before the Canadian Mining Institute, Montreal)

By G. M. Colvocoresses, Humboldt, Ariz.

(Concluded)

In the roasting furnace we shall probably plan to raise the heat of the calcines in the lower hearth of the furnace to such a point that these calcines mixed with a proper binder will nodulize and be suitable for treatment in a blast furance instead of for treatment in electric furnaces which have been utilized for reducing the ore up to the present time. Nodulizing certain ores of iron in roasting furnaces or special kilns is an established practice and there is no reason why it cannot be accomplished equally successfully in the treatment of the Sudbury ores.

After our ore is roasted we have practically an iron oxide ore which is hematite or in part magnetite and containing the oxides of nickel and copper as well as of iron and the next step is naturally the reduction of this ore, which may be carried out in an iron blast furnace using coke, or in an electric furnace where the reducing agent must be added in the shape of coke, coal or charcoal. In any case limestone must be added as a flux to slag off the silicates.

Comparison of the blast furnace with the electric furnace for the reduction of the ore has been made under many varying conditions and although with very cheap electric power it may appear that the electric furnace would have some advantage over the coke fired blast furnace, still in practice it does not seem to work out this way and for operating on a large scale I have become convinced that blast furnace treatment is preferable to treatment in the best type of electric furnace, although possibly in future conditions may change so as to give the electric furnace the advantage.

The product of the reducing furnace is an alloy pig containing iron, nickel and copper in the same relative proportions as in the ore originally charged into the furnaces, or in such altered proportions as may have been brought about by the addition of other iron bearing material and we are able to regulate the carbon as may be desired. Operating on a large scale we would plan to run the molten pig directly into a refining furnace, either an open hearth or electric furnace, or possibly some modified type of Bessemer converter, and to follow immediately with the refining to steel using a little additional lime to slag off the sulphur in the pig and reducing the carbon with hematite in the usual manner and it is particularly in this portion of the process that great care is required in order to make exactly the alloy-steel desired and to regulate the quantity of the nickel and copper which must enter into the finished steel.

Up to the present, not being equipped for continuous operation of the process we have been obliged to allow the pig metal to cool and then to re-charge it into the refining furnace, but first we utilized an electric furnace for the steel making and got good results except that the heats were comparatively small in tonnage and required more time and expense than was desirable. Later we re-charged the pig metal into an open hearth steel furnace of the ordinary type and met with the greatest success in converting the pig to open hearth alloy-steel. The open hearth operated on this pig in a very successful and satisfactory manner, in every way comparable to the operation on ordinary pig iron, and it required no more time or expense to make the alloy-steel than is required for the production of ordinary carbon steel by the same method. An objection that might be urged against the operation of the open hearth on the alloy pig is in connection with the sulphur contained in such pig, provided same were made from an ordinary blast furnace which has not the same desulphurizing action as the electric furnace, but the data which we have gathered seems to show that if the preliminary roasting is carried sufficiently far the blast furnace pig will not contain more than 0.50% sulphur, which is well

within the limits permissible for treatment in open hearth steel furnaces.

We are operating, of course, on a combination of three metals instead of on a material containing only one metal and we are treating these three metals as if they were one and carrying them in close intimate combination from the start to the finish of the process, and in doing this there are certain special considerations which have to be taken into account and we have already learned some valuable practical points in connection with our operations and no doubt will steadily be able to improve the practice as we gain more experience.

The process which I have described above with a few modifications is applicable to the blast furnace and reverberatory slags of which there are some 8,000,000 tons now available in the Sudbury District, containing on the average, say, 40% iron; .40% nickel; .20% copper.

Here we have an artificial iron ore with so little sulphur that it does not need to be roasted, but carrying a much lower percentage of nickel and copper than the true ore in the ground and with rather more copper in proportion to the nickel than we desire. It is purely a question of commercial profit as to whether these slags can be utilized to advantage and for the production of over 3,000,000 tons of alloy-steel. The steel which we have made from slag is of excellent quality, but with nickel and copper contents too low to make it a substitute for average 3% nickel steel and it is, therefore, my idea that these slags can best be treated at the same time as the ore, and in combination with the roasted ore, thereby obtaining from the mixture a steel which will carry about 3% nickel and copper (combined) with the proportions of the two metals about 3 or 4 to 1.

Now there are many ores in the Sudbury District which do not contain the correct percentages of nickel and copper for the manufacture of Nicu steel; in some cases the copper is in excess of one-half of the percentage of nickel, and in a few special cases the copper is as high or higher than the nickel contained; so also in the Arts and Industries there will always be requirements for a large amount of nickel in other combinations than as nickel-steel. We can say for example that at present about one-quarter of the entire nickel production is used apart from steel altogether. Some of the nickel and copper becomes "Monel metal," which is very valuable for certain purposes; some of the nickel is used as an alloy for bronze, or the manufacture of "German silver"; some is used for coinage purposes, (either pure or alloyed with copper) and some for nickel plating where a very pure nickel is required. So, even if the Nicu process should find general adoption there would still be room for the treatment of ores which did not carry the correct percentages of nickel and copper and which would naturally be treated along the lines of the present metallurgical processes for the production of pure nickel, pure copper, or Monel metal.

The processes which I have described are covered by patents, both in the United States and Canada and these patents are now owned by the Nicu Steel Corporation, Limited.

After describing experiments made at the company's plant, East Montreal, the author states:

In 1916, Dr. Stansfield of McGill University, at my request, experimented with the Nicu process and made some excellent steel, and a little later Professor Guess, of Toronto, working under the direction of the Ontario Nickel Commission, also did some valuable work along the same lines and reports of their experiments, together with the tests made upon the steel produced, and on other similar steels, are embodied in the Report of the Royal Ontario Nickel Commission, which is altogether the most valuable treatise on nickel that has yet been published.

My experiments show that the best product is produced when the copper does not exceed one-third of one-quarter the percentage of nickel contained in the finished product. There was one experiment carried on by the Ontario Government in which they made a steel containing about an equal amount of nickel and copper, which showed up very nicely indeed in the mechanical tests, but my own experience with steel of approximately this composition had not been very successful, and I would not care to recommend any Nicu steel in which the copper is in excess of 40% of the nickel contained, or preferably not more than 30%; moreover, the total copper content should probably not exceed 1%, if the steel is to be used for the same purposes as the nickel-steel and the copper is to act as replacing the nickel which we find that it does up to certain percentages. A great deal of nickel-steel as used at present contains 3% nickel and we have found that Nicu steel containing 2.25% nickel and 0.75% copper is in all respects similar and equal to the nickel-steel mentioned.

I will say that in some respects Nicu steel is a better steel than ordinary commercial nickel-steel, because it is a more homogeneous mixture and more uniform in composition. Nickel-steel is made by adding nickel or nickel oxide to steel in the bath of the open hearth furnace; i.e., nickel is added in the final process of steel making and is kept in combination with the iron after melting, during the period of say five or six hours. The theory of alloys teaches us that the nickel forms a solid solution with the iron, but it is a question just how complete and how uniform this solution can be made and the problem that has confronted steel makers has been to secure a thoroughly uniform composition of any alloy and to prevent segregation in various parts of the ingots produced. In the Nicu process we figure out our charge and our alloy mixture before we smelt the ore into pig and in so far as possible the final percentage of nickel, copper and iron is arranged for by mixing the ores before any smelting takes place, or during the first stages of the smelting. The sulphides or oxides of the three metals are then combined at the very outset of our operations and the pig metal contains these metals in approximately the same proportion as the finished steel, the nickel combining freely with both iron and copper and never releasing them throughout the entire process. Perhaps in blast furnaces or a shaft electric furnace there would be times when the composition of the metal might not be entirely uniform, but such a condition is rectified in the refining furnace and the final alloy-steel should be of uniform composition and a more perfect mixture than ordinary alloy-steel made by the present methods and so far as we have been able to determine this actually results from carrying out the Nicu steel process.

Aside from the mechanical qualities of the steel, there is reason to believe that the addition of copper tends to decrease the corrosibility of the alloy and to render it less subject to the action of acids, salt water, etc., and hence makes it especially valuable for ship building, pump parts and numerous other uses. Clamer experimented at considerable length on the effects of acids, salt air and salt water on nickel-copper steel made from Monel metal and found its resistance most remarkable, while the beneficial effect of the addition of small quantities of copper to ordinary steel has been known for a long time and taken advantage of by steel-makers to make special brands of non-corrosive steel for roofing and similar purposes.

We do not yet know how Nicu steel will behave in armour plate, but judging from the fact that Monel metal steel made excellent armour piercing projectiles, we believe that a Nicu steel armour plate will be well worth trying out. We do not know how it will behave when rolled into rails, but from tests which have been made for other purposes, there is every reason to think that Nicu steel rails will prove very useful and valuable if they can be manufactured at only a little greater cost than the ordinary steel rails.

The cost of manufacture is yet to be determined on a commercial scale, but the author estimates the total cost of making the alloy pig will be \$23.00 a ton, estimating the smelter cost at \$12.00.

The author proceeds: The Nicu process will not provide a means of recovering the precious metals (gold, silver and the

metals of the platinum group), occurring in the ore to the average value of say fifty cents per ton, (of which less than 40% is saved by present methods), but it can save 98% of the nickel against 80% saved by the present methods; 98% of the copper against 83%; 96% of the iron and probably 80% of the sulphur, both of which are entirely lost at present. Turning back to the figures quoted at the beginning of this paper and assuming that the gross value of the useful base metals in the Sudbury, 1918, production to be $90,000,000, I repeat that metals to the value of only $44,000,000 will be saved this year, whereas the general application of the Nicu process for ore and slag would result in the saving of metals with a value of $41,000,000 additional, making a total recovery of 94% against 49%, and with a very comfortable profit to the operators.

It would establish a new industry in Canada: an industry which may produce annually close to 600,000 tons of high-grade alloy-steel largely from material now thrown away, or nearly 40% of the total steel produced in the Dominion at the present time.

Nitrogen and Its Compounds

By Horace Freeman, Niagara Falls, Ont.

(Concluded from April issue)

Manufacture of Cyanamid

The raw materials used in the manufacture of Cyanamid are the atmosphere, lime and coke, and to bring them into the proper combination a plentiful supply of electric power is required.

Calcium carbide is first prepared from the lime and coke in electric furnaces, and is then made to combine with nitrogen from the atmosphere in electric ovens.

Moissan first prepared calcium carbide in Paris in 1892, but though he made many attempts to effect the combination of his product with nitrogen, he was unsuccessful. The carbide which Moissan prepared in his laboratory was chemically pure or nearly so, and it was later shown by Frank and Caro in Germany that only technical carbide containing over 5% or so of lime and other impurities was capable of absorbing the cyanamid industry, and the manner in which this apparently simple invention was financed and supported in Germany is an outstanding example for us to take heed of.

The manufacture of calcium carbide was brought to commercial possibility at Niagara Falls, New York, very soon after the discovery of Moissan, and it was quickly developed in Europe as a consequence wherever cheap electric power was to be obtained. The production of carbide soon became so great that many of the plants were forced temporarily to close, owing to glutting of the market. The invention of cyanamid was their ultimate salvation.

Calcium carbide is manufactured in large electric furnaces into the top of which hang large blocks of carbon about six feet long. The lower ends of these electrodes dip into the centre of the furnace, which is filled with a mixture of coke and lime, continually shovelled in at the top. Electric current passes between the ends of the electrodes and through the mixture which is heated by this means until the lime melts to a liquid, and then undergoes a chemical reaction with the coke, the result being calcium carbide which collects in a pool in the furnace, and is periodically tapped out into heavy iron chill cars, wherein it is allowed to cool

Before the carbide is in shape to combine with nitrogen it is crushed and ground to a fine powder. Next it is placed in large perforated steel cans, and these cans are set each inside a separate gas-tight oven constructed of firebrick. A thin rod of carbon passes through the centre of the oven and through the central axis of the can. The passage of an electric current through the pencil heats it to a high temperature and so transfers heat to the carbide immediately surrounding the pencil. A constant supply of nitrogen gas is fed into the oven and is rapidly absorbed by the hot carbide. The chemical reaction which takes place evolves sufficient heat to heat the next communicating layer of the carbide to the reaction temperature and so the process repeats itself until the whole contents of the can are red hot. The nitrogen gas supply is continued until the contents of the can are sufficiently nitrified.

The most important ingredient of this process, the nitrogen, is obtained from the atmosphere. The air is drawn in through pipes some distance from the plant in order to have it free from dust. It is compressed at about 500 pounds to the square inch and then by sudden expansion is automatically cooled to about 380 degrees below zero, at which temperature it turns to a liquid. This liquid air is then allowed to undergo a process similar to distillation, by which means the nitrogen boils off and is conducted to the fixation ovens containing the carbide. Seventy-five per cent. of the liquid air is nitrogen and twenty-five per cent. is oxygen. The oxygen is all left behind in this fractionation process.

The product from the fixation ovens is in the form of a solid black mass and is called Lime Nitrogen. It contains more than twenty per cent. of nitrogen, but is not yet ready for the market as a fertilizer ingredient. To make it suitable for this purpose it is crushed and ground to a fine powder and is hydrated by admixture with a small quantity of water. This converts the carbide and quick-lime remaining in the lime nitrogen into hydrated lime. One or two per cent. of mineral oil is also added to render the product less dusty, and it is now in shape for shipment under the trade name of "Cyanamid." It is a grey-black powder and may be used directly on the land, but usually is purchased by the compound fertilizer manufacturers, who mix it with substances containing the two next important plant foods: potash and phosphoric acid.

Some of the Derivatives of Cyanamid and Their Uses

Up to the beginning of the war the cyanamid produced in this country was nearly all sold for its prime purposes as a plant food, but the demand for nitrogen compounds in various highly important industries which bear directly upon war requirements has created a demand for its use in the preparation of a variety of interesting substances.

Ammonia

Cyanamid readily yields all of its nitrogen content in the form of ammonia by treatment with steam under pressure. Ammonia is easily converted in turn into the majority of other useful compounds containing nitrogen.

Ammonia is used in so many ways in the chemical and allied industries that it would be almost impossible to enumerate them, but it is most widely known for its value for purposes of refrigeration.

"Ammo-Phos"

The ammonia produced from Cyanamid is largely converted into a substance called "Ammo-Phos," by absorbing it in a solution of crude phosphoric acid, the phosphate rock of Florida being the source of raw material for the purpose. "Ammo-Phos" has the advantage that it carries within itself two of the most necessary plant foods, containing as it does thirteen to twenty per cent. of ammonia and from twenty to forty-seven per cent. of phosphoric acid in forms which are easily soluble and readily available to the plant. Moreover, the proportions of the ingredients in "Ammo-Phos" may be regulated for any desired mixture and the nature of the material is such that it is entirely without those objections appertaining to the usual run of fertilizers, may be kept indefinitely without loss of values and may be mixed with any other combination of plant foods desired by the fertilizer manufacturer.

"Ammo-Phos," on account of its concentrated nature, is able to replace many other forms of mixed fertilizer, and for this reason it may well be claimed that its manufacture will be one of the great advances made to solve the important problem of

increasing food production. It is manufactured by the Cyanamid Company at a plant in New Jersey.

Ammonium Sulphate

Next in importance as a product of cyanamid is Ammonium Sulphate. This substance, which is used in enormous quantities as a fertilizer ingredient, is manufactured by absorbing the ammonia gas from cyanamid in sulphuric acid. The ammonium sulphate is crystallized in the form of a white crystalline compound from the resulting solution and contains over twenty-five per cent. of ammonia. Its manufacture is also carried out at the New Jersey plant from the Cyanamid produced at Niagara Falls.

Ammonium Nitrate

By absorbing the ammonia gas in nitric acid ammonium nitrate is formed. This substance is now in great demand by the explosives industries and is the basis of the explosive "Ammonal," which is a mixture of ammonium nitrate and aluminum powder. Ammonium nitrate is also mixed with T.N.T. and is so used in high explosive shells.

Nitric Acid

The nitric acid required for the manufacture of ammonium nitrate is at the present time the most important compound which may be produced from the nitrogen of the atmosphere, for it enters into the composition of all military explosives which could not be manufactured without it.

The manufacture of nitric acid from cyanamid has been successfully developed to a manufacturing scale and has become of great importance since 1914, as it provides an alternative from the Chilean nitrate source of supply, and has been made use of by Germany on a large scale.

For the production of nitric acid from ammonia, the ammonia gas is mixed with air in suitable proportion and the mixture of gases is led over a catalyzer at a dull red heat. By the action of the catalyzer the ammonia is oxidized and the gases issuing from the chambers wherein the process is carried out contain oxides of nitrogen, which when dissolved in water form nitric acid. The nitric acid solution may be concentrated and sold for a multitude of purposes or it may be used directly in connection with the ammonia plant for the production of ammonium nitrate with high efficiency.

Most people have heard of T.N.T. since the outbreak of the war. It is the most widely used explosive on the battle fronts. T.N.T. is made from toluene, a substance very similar to benzine and obtained with benzine in the purifying of coal gas. The toluene is mixed with nitric acid in three separate treatments and a substance called tri-nitro-toluene is the result under certain conditions used in the process for this purpose.

T.N.T., as it is familiarly called, is usually orange colored and somewhat resembles wax, and, like wax, may be easily melted. Shells are filled with safety by melting it over steam and pouring it into the upturned shells which are left to cool until the contents are solid. T.N.T. is inflammable, but not explosive until detonated in a confined space. It cannot be made without nitric acid.

Detonators for air explosives contain fulminate, a highly dangerous substance which explodes on percussion and which also requires nitric acid for its manufacture. For the manufacture of fulminate, mercury is dissolved in nitric acid and the solution is poured into alcohol at a temperature of 55 degrees Cent. The product is a grayish white precipitate, which must be washed and stored under water. Silver may be used in place of mercury for this manufacture, but the product is even more dangerous to handle. The percussion caps of shells or cartridges contain fulminate. A slight blow on the cap suffices to explode the fulminate which in turn fires the high explosive contained in the shell.

Cyanide

Case hardening compounds play an important part in the munitions industries. A mixture of cyanamid and salt when heated produces cyanide and makes an excellent case-hardening compound, which is cheaper than other substances used for the purpose.

The manufacture of cyanide for gold and silver extraction is an important development of cyanamid. Cyanide was largely produced in Germany at the outbreak of war and that country had a practical monopoly of the cyanide trade. The cyanamid produced there, however, was not made from cyanamid or atmospheric nitrogen, but from ammonia and metallic sodium under the invention of Hamilton Y. Castner, whose name is well known for other important industrial developments at Niagara Falls. The process of Castner is expensive for a chemical in such great demand as cyanide, and many attempts have been made to find cheaper means of production, and it was in the search to this end that Frank and Caro discovered cyanamid.

The blockade of Germany has cut off a large amount of the cyanide supply to this great mining country and the natural result has been to revive attention to means of securing cyanide from cyanamid.

It has now been found that cyanamid will yield its nitrogen all in the form of cyanide by fusing the cyanamid with salt at a high temperature and the crude cyanide obtained is used successfully without purification for the extraction of gold and silver from ores.

This process of producing cyanide also has been developed first to a large manufacturing scale at Niagara Falls, and its product has already been used in the extraction of large quantities of the precious metals.

For the purpose of gold and silver extraction a very weak solution of cyanide is agitated with the finely crushed ore. The gold and silver are dissolved by the action of the cyanide and the filtered solution containing these metals is treated with finely divided zinc, whereby the precious metals are deposited in the form of a black sludge. This is melted and yields bars of base bullion which are sent to the refinery.

The use of cyanide for case-hardening purposes has been referred to. Its third important use is an insecticide, and large quantities are used in orchards, greenhouses and government inspection stations where incoming nursery stocks are examined and treated. The cyanide for this use is sometimes sold in small zinc cartridges or containers. A cartridge is dropped into a dish of sulphuric acid placed in the greenhouse or tent erected over the tree or plants under treatment. The acid attacks the zinc, dissolving it away and next acts upon the cyanide producing prussic acid which is instantly fatal to all living things.

Vast amounts of prussic acid made from cyanide are now used on the battle fronts. It is a colorless gas at the ordinary temperature, lighter than air but instantly fatal unless very much diluted with the atmosphere. Where it is not fatal the after effects of this gas are not nearly so terrible as those of chlorine. It is possible that future developments in this direction might produce a gas either extremely quick and painless in its action or without after effects in case a complete fatal dose had not been inhaled. There is no doubt that Germany's great stocks of cyanide which she had not been able to export are being used in the preparation of prussic acid for use at the front.

Dicyandiamid

Another development of cyanamid that has been brought into practice here is Dicyandiamid, a white crystalline substance used in the preparation of dyes and as a deterrent or retarder in explosives. It is prepared by extracting cyanamid with hot water and recrystallizing the dissolved dicyandiamid from the resultant solution. Its effect in mixtures with explosives is to reduce the temperature of explosion and so serve to increase the life of the gun barrel.

A number of organic compounds have been produced in the laboratory from cyanamid, for which no great commercial uses

have yet been developed and consequently methods of manufacturing practice have not been worked out. It will readily be conceded that cyanamid is the most useful and remarkable nitrogen compound available to our use and its development in our midst is a matter of the highest importance to our welfare. The world is producing over one million tons of cyanamid each year, and of this Germany is manufacturing more than six hundred thousand tons containing approximately one hundred and twenty thousand tons of nitrogen taken from the atmosphere. The greater portion of this fixed nitrogen is used by Germany on the battle line in the form of high explosives; the remainder she uses at home to increase the food production of the country.

Potash Leases in Western School Lands

A Dominion Order-in-Council has been passed authorizing the leasing of potash rights in school lands in Manitoba, Saskatchewan and Alberta. The regulations which have been published in the Canada Gazette, give the right to naturally occurring compounds containing sulphate or chloride of potassium in a condition directly soluble in water. Applicants for leases pay a rental of 25 cents per acre for the first year and 50 cents per acre for each subsequent year, payable yearly in advance. The term of lease is twenty-one years, renewable for a further term of twenty-one years, provided the lessee shows that he has complied with the conditions of the lease and with regulations that may be made from time to time. The maximum area to be leased is 640 acres, and no lessee can acquire a greater area except by assignment. In any case, no individual or company can acquire the lease of an area exceeding 2,560 acres. The lessee shall within a year from the date of his lease have on the leased lands machinery and equipment such as the Minister shall consider necessary. Failure in this respect will subject the lease to cancellation, but the Minister shall not require that machinery exceeding a value of $5,000 shall thus be installed. The lessee is expected to commence boring within fifteen months of the date of his lease. The lessee who acquires another area by assignment may consolidate his operations with the newly-acquired property, but boring operations must be carried on within the prescribed time in the newly-acquired area. In case the surface rights of a location are covered by a timber license, grazing or coal mining lease, the potash lease shall not be granted without the permission of the Minister and protection of the rights of these leases. A fee of $5 shall accompany each application for a lease. The other conditions are set forth in the Gazette.

Society of Chemical Industry

On March 25th a meeting of the Society of Chemical Industry, Canadian Pacific Section, was held in the Council Room of the Board of Trade, Vancouver, Mr. J. A. Dawson in the chair.

Mr. A. Hallden read a paper on "By-products from Wood Waste and Wood Pulp Liquors."

After a short review of the development of the pulp and paper industry, Mr. Hallden described the manufacture of wood alcohol from the digester gases of sulphite and sulphate pulp mills. The methyl alcohol is condensed by cooling the gases, the condensate distilled and neutralized with lime and then refined. The cost of the necessary equipment and the expenses for operation are very small. Cymene and fufural are very valuable products recovered from the gases. A color industry based on cymene has been started in Finland.

Mr. Hallden referred to the sulphite waste liquors now allowed to flow into the streams and the sea. The waste liquor contains nearly half of the original wood used in cooking sulphite pulp. It may be used for road covering instead of tar, for making tanning extracts, for fuel, as raw material for alcohol and other purposes. Where coal is scarce pulp mills may supply their own fuel by recovery from the waste liquor. They are also if necessary able to make their own lubricating oil from the resin. The speaker then gave a description of the production of ethyl alcohol from the waste liquor. This process was carried out, he said, in half a dozen pulp mills in Sweden and in one mill in the United States, the production in these mills being around three million gallons, fifty per cent. alcohol per year. The waste liquor containing the sugar is neutralized by slaked lime together with limestone, the sludge allowed to settle, the clear liquor fermented and distilled, giving a 91 per cent. alcohol before being purified. Another process using sulphuric acid has been used in the United States, but is more expensive. Mr. Hallden estimated that from the sulphite pulp mills in British Columbia 800,000 gallons of 100 per cent. alcohol could be recovered per year. This now goes in the sea. Alcohol is now prohibited for beverage purposes, but there is a large demand for it in the munitions industry, and for other industrial purposes. To use grain for making alcohol to fill this demand is a waste of food. Later there would be a market for alcohol in competition with gasoline for running motors and autos, and instead of kerosene for heating.

Chemical wood pulp, is now-a-days used not only for making paper, but also for making clothing, sacks, twine, gun-cotton, airplane varnish, artificial leather and silk, and other purposes.

In logging and cutting the logs to lumber there is a large waste of wood in our woods and sawmills. Providing the market were found, charcoal could be made of part of this waste, at the same time recovering chemical products from the tar and gases from the coal ovens. Charcoal has just been made on a small scale here in British Columbia. A small quantity of potash can be recovered from the waste burners of sawmills operating on Douglas fir. Alcohol may also be made directly from wood waste by cooking with diluted sulphuric acid, fermenting and distilling the mash, using the cooked chips for fuel.

After the paper a discussion followed in which Prof. McIntosh expressed his belief that fermenting process for producing alcohol from wood had possibilities here and that research work may be started in British Columbia.

Canadian Barium Industry

The Continental Chemical Company, of Kingston, Ont., have leased the plant formerly occupied by the Buffalo and Ontario Smelting Company. This plant is equipped with reverberatory furnaces, tanks, etc., and although exteriorly it is out of repair, it is expected that in another month it will be in a shape to make the first lot of Blanc Fixe (artificial $BaSO_4$). Other heavy chemicals, as sal soda, caustic soda and lime products will be produced in connection with the making of the barium chemicals.

The barium industry in the United States is growing by leaps and bounds. The report on Mineral Resources of the United States, 1916, says: "A domestic industry for the manufacture of barium chemicals has been established and put on a firm foundation in the last two years, and the manufacture of lithopone and ground barytes has been further expanded. The value of barium products of domestic manufacture made in 1916 was more than $8,500,000."

As far as we know there is no firm in Canada making barium chemicals. One firm in Cape Breton grinds the crude barytes and markets it in Canada. Blanc Fixe or permanent white is a pigment largely used in the paint industry, in the manufacture of highly glazed papers and of putty, and in the fabrication of rubber and lake colors. Barium carbonate is now used for case hardening of steel instead of bone ash.

The raw supply of barytes for the Kingston industry will partly be obtained from a vein which crosses the country for a long distance. This vein has been traced for many miles, but there are only a few spots where it seems to be well defined, and large enough to produce a satisfactory supply. There are other deposits farther north of Kingston, and a supply can be obtained from the Cobalt country.

Dr. I. G. Bogart, surgeon, of Kingston; Mr. Edwin D. Chaplin, chemical engineer, of Boston and New York, and Mr. A. MacKinnon are the principal movers in the new enterprise.

Mineral Production of Canada for 1917

Preliminary Report by John McLeish, Chief of Division of Mineral Resources, Ottawa.

(Continued from April issue)

Silver

The production in silver of 1917 was 22,150,680 ounces, valued at $18,034,419, as against 25,459,741 ounces, valued at $16,717,121 in 1916, a decrease of 13.0 per cent in quantity, but an increase of 7.9 per cent in value. The high value of the production in 1917 was exceeded only in 1912 and 1913, when the Cobalt camp was at the maximum of its output. The production in Ontario amounted to 19,254,616 ounces, valued at $15,676,531, or 87 per cent of the total production for Canada. In 1911, the year of its maximum production, the percentage was 93.8. The production was from the ores of Cobalt and adjoining silver camps, with the exception of 80,863 ounces, the output of the gold and copper mines.

Zinc

During the past two years there has been a recovery of refined zinc in Canada at the zinc refinery erected by the Consolidated Mining and Smelting Company at Trail, B.C. Prior to 1916 all zinc ore mined in Canada was exported for smelting and refining. The establishment of the Trail plant has resulted in the mining and treatment of a much larger tonnage of zinc ores and a portion of the present production is still being exported for treatment. The total recovery during 1917 in Canada of refined zinc, together with the zinc contained in ores exported (less 20 per cent allowed for smelter losses) amounted in 1917 to 31,227,351 pounds, which at the average price of spelter in New York, 8.901 cents per pound, would have a total value of $2,779,547. The corresponding production in 1916 was 23,364,760 pounds, valued at $2,991,623, or an average of 12.804 cents per pound. Quebec in 1917 is credited with 1,161,062 pounds, and British Columbia with 30,066,289 pounds. In 1916 the Quebec production was 1,663,200 pounds, and British Columbia 21,701,560 pounds. The total zinc ore shipments from mines in 1917 were about 116,660 tons, containing, without any deduction whatever, 61,920,149 pounds of zinc. The total ore shipments in 1916 were 82,077 tons, containing 48,498,078 pounds of zinc.

Iron Ore

The total shipments of iron ores from Canadian mines during 1917 were 215,242 short tons valued at $758,261 as compared with shipments of 275,176 tons valued at $715,107 in 1916. The 1917 shipments included 198,092 tons from mines in Ontario and 17,150 tons from mines in Quebec, and of the latter amount a considerable tonnage was from old stock piles. The ores comprised 197,602 tons of hematite and roasted hematite and siderite 12,664 tons of magnetite and 4,978 tons of titaniferous ores.

The principal operating properties were the Helen and Magpie mines of the Algoma Steel Corporation all of the ores mined being first roasted before shipment. The Moose Mountain Company continued development and experimental work in concentration and briquetting but made only small shipments. In Quebec shipments of ilmenite were made from Ivry-on-the-lake in Terrebonne county and of titaniferous ore from St. Urbain on the north shore of the St. Lawrence. Shipments of magnetite were also made from stock piles at the Bristol mine in Pontiac county and a small tonnage from Ironsides, in Hull township.

The total quantity of iron ore charged to blast furnaces in 1917 was 2,176,296 tons of which 92,065 tons were of domestic origin and 2,084,231 tons imported. The imported ore included 874,134 tons of Newfoundland ore and 1,210,097 tons of "Lake ore." Shipments of iron ore from Wabana mines, Newfoundland in 1917 by the two Canadian companies operating there were 883,346 short tons, as against 1,012,060 tons in 1916 all of which went to Sydney and North Sydney in Cape Breton.

Pig Iron

The production of pig iron in blast furnaces during 1917 was supplemented by a small production of high grade low phosphorus pig iron in electric furnaces made from shell turnings and other steel scrap. The total production from both sources (not including the output of spiegeleisen, or other ferro-alloys) was approximately 1,171,789 short tons (1,046,240 gross), final returns not yet having been received from all manufacturers of electric pig iron. Of the total, 1,156,789 tons were produced in blast furnaces and the balance in electric furnaces. In 1916 the production all made in blast furnaces was 1,169,257 short tons (1,043,979 long tons.)

The small increase in pig iron production in 1917 was therefore due entirely to the electric furnace production, there having been an actual falling off in the blast furance output.

By grades the 1917 production included: Basic 14,092 tons; Bessemer, 961,656 tons; Foundry and malleable, etc., 181,041 tons; electric furnace pig (subject to revision), 15,000 tons. The 1916 production included: Basic 953,627 tons; Bessemer 31,388 tons; foundry and malleable, etc., 184,242 tons.

The blast furnace plants operated were the same as in the previous year, viz: the Dominion Iron & Steel Company at Sydney, N.S., the Nova Scotia Steel & Coal Company, at North Sydney; the Standard Iron Company at Deseronto, Ont., The Steel Company of Canada, at Hamilton, Ont.,The Canadian Furnace Company, at Port Colborne, Ont., and the Algoma Steel Corporation at Sault Ste. Marie, Ont. Pig iron was made in electric furnaces by: The Canada Cement Company, Ltd., Montreal; Frazer, Brace & Company, Ltd., Shawinigan Falls, Que; British Forgings, Ltd., Toronto, Ont.; Electro Foundries, Ltd., Orillia, Ont.; and Turnbull Electro Metals, Ltd., St. Catharines, Ont. The total production in electric furnaces of pig iron ferro-alloys and steel ingots and castings was in 1917 about 99,000 short tons.

The production of ferro-alloys in Canada in 1917, chiefly ferro-silicon but including also spiegeleisen, ferro-molydbenum and ferro-phosphorus, all with the exception of the spiegeleisen, being made in electric furnaces, reached a total of 40,329 tons valued at $3,471,934, as against a total in 1916 of 28,628 tons valued at $1,777,615.

The exports during 1917 of pig iron were 12,081 tons, valued at $423,814 or an average of $35.08 per ton and of ferro-alloys 33,212 tons valued at $2,616,924, or an average of $78.79 per ton.

The imports during 1917 included 82,758 tons of pig iron valued at $2,744,055 or an average of $33.16 per ton; 632 tons of charcoal pig iron valued at $19,447, or an average of $30.77 per ton, and 12,828 tons of ferro-alloys valued at $2,029,990, or an average of $158,25 per ton, making a total import of pig iron and ferro-alloys of 96,218 tons valued at $4,793,492. The United States trade records show exports to Canada during the eleven months ending November 1917 of pig iron and ferro-alloys amounting to 130,087 gross tons (145,697 short tons) valued at $5,170,005 a figure considerably higher than the Canadian record.

Steel

The estimated production of steel ingots and direct steel castings in 1917, final returns for all operations not yet having been received, was 1,736,514 short tons, (1,550,459 gross tons) of which 1,690,170 tons were ingots and 46,344 tons direct steel castings. The total production in 1916 was 1,428,249 tons compared with which the 1917 production shows an increase of 308,265 tons, or 21.6 per cent. The total production of electric steel in 1917 was probably not less than 50,000 tons as against 19,639 tons in 1916 and 5,625 tons in 1915.

Mineral Production by Provinces, 1916 and 1917

	1916		1917	
	Value of Production	Per cent. of Total	Value of Production	Per cent. of Total
Nova Scotia......	$20,042,262	11.31	$25,333,643	13.13
New Brunswick...	1,118,187	0.63	1,372,620	0.71
Quebec...........	14,406,598	8.13	17,115,161	8.87
Ontario...........	80,461,323	45.41	88,821,815	46.02
Manitoba.........	1,823,576	1.03	2,539,393	1.32
Saskatchewan.....	590,473	0.33	832,335	0.43
Alberta...........	13,297,543	7.50	16,426,154	8.51
British Columbia..	39,969,962	22.56	36,161,528	18.74
Yukon...........	5,491,610	3.10	4,380,188	2.27
Dominion.......	177,201,534	100.00	192,982,837	100.00

The Mineral Production of Canada in 1917

(Subject to Revision)

		Quantity	Value
Metallic			
Antimony ore (exports)	*Tons	774	50,476
Cobalt, metallic contained in oxide, etc.	Lbs.	1,089,134	1,742,614
Copper, value at 27.180 cents per lb.	Lbs.	108,860,358	29,588,254
Gold	Ozs.	747,366	15,449,426
Iron, pig from Canadian ore	Tons	46,022	768,783
Iron ore sold for export	Tons	169,192	590,336
Lead, value at 11.137 cents lb.	Lbs.	32,072,269	3,571,889
Molybdenite (MoS_2 contents at $1 per lb.)	Lbs.	271,530	271,530
Nickel, value at 40 cents per lb.	Lbs.	84,470,970	33,778,388
Platinum	Ozs.	49½	5,090
Silver, value at 81.417 cents per oz.	Ozs.	22,150,680	18,034,419
Zinc, value at 8.901 cents per lb.	Lbs.	31,227,351	2,779,547
Total			$106,630,752
Non-Metallic			
Actinolite	Tons	120	1,320
Arsenic, white and arsenic in ore	"	....	709,937
Asbestos (b)	"	144,185	7,215,389
Asbestic	"	9,596	18,688
Barytes (b)	"	958	16,000
Chromite (a)	"	36,352	490,001
Coal	"	14,015,588	47,643,646
Corundum	"	188	32,153
Feldspar (not complete)	"	11,493	54,555
Fluorspar	"	4,249	68,756
Graphite	"	3,714	402,892
Grindstones	"	2,279	44,037
Gypsum	"	339,418	887,170
Magnesite	"	58,090	728,275
Manganese	"	158	14,836
Mica		......	350,732
Mineral pigments: iron oxides	"	9,372	81,685
Mineral water		......	145,276
Natural gas	M. cu. ft.	26,465,686	5,003,342
Petroleum	Brls.	205,332	478,937
Pyrites	Tons	403,243	1,586,091
Quartz	"	205,851	440,444
Salt	"	138,909	1,047,792
Talc	"	15,812	76,539
Total		....	$67,249,514
Structural Materials and Clay Products			
Cement, Portland	Brls.	4,768,488	7,699,521
Clay products: $4,603,755—			
Brick: Common		....	2,017,046
Brick: Pressed and paving		....	589,406
Kaolin	Tons	533	9,594
Pottery		....	122,878
Refractories: Fireclay, firebrick, etc.		....	210,838
Sewerpipe		....	778,159
Tile		....	434,465
All other: Fireproofing, hollow blocks, etc.		....	441,369
Lime	Bush.	6,338,212	1,517,918
Sand and Gravel	Tons	7,157,279	1,908,773
Sand-lime brick	No.	12,432,990	143,393
Slate	Sq.	1,422	7,789
Stone: $3,221,422—			
Granite		....	613,588
Limestone		....	2,291,692
Marble		....	55,820
Sandstone		....	260,322
Total structural materials and clay products		....	19,102,571
All other Non-metallic		....	67,249,514
Total value Metallic		....	106,630,752
Grand Total, 1917			$192,982,837

Metal Prices

(In cents per pound or ounce)

	1912	1913	1914	1915	1916	1917
Antimony (ordinaries), per lb.	7.760	7.520	8.763	30.280	25.370	20.690
Copper, New York, per lb.	16.341	15.269	13.602	17.275	27.202	27.187
Lead, New York, per lb.	4.471	4.370	3.862	4.673	6.858	8.787
Lead, London, per lb.	3.895	4.072	4.146	4.979	6.715	6.626
Lead, Montreal, per lb.	4.467	4.659	4.479	5.600	8.513	11.137
Nickel, New York, per lb.	40.000	40.000	40.000	45.000	45.000	50.000
Silver, New York, per oz.	60.835	59.791	54.811	49.684	65.661	81.847
Spelter, New York, per lb.	6.943	5.648	5.213	13.230	12.804	8.901
Tin, New York, per lb.	46.096	44.252	34.301	38.500	43.480	61.802

(Concluded in next issue)

Industrial News

The Brompton Pulp and Paper Company, East Angus, Que., has acquired the Howland Paper Company, at Howland, Maine, and will operate it under the old name.

Mine owners and operators in British Columbia are petitioning the Government, through Mr. C. F. Caldwell, for the imposition of a duty on lead ore and bullion being shipped into Canada.

The Imperial Oil Company's tender for the supply of one thousand tons of asphalt, at $32 a ton, was accepted by the civic commissioners of Montreal.

The name of the Canadian Society of Engineers has been changed to the Engineering Institute of Canada. It is expected that the Nova Scotia Society of Civil Engineers will amalgamate with the Institute.

A new copper furnace has been blown in at the Consolidated Mining and Smelting Company's smelter at Trail, B.C. It is the intention of the management to operate the copper refinery to the fullest extent.

A deposit of coal has been found by the engineers of the Hydro constructing the Chippewa-Queenston Hydro Power Canal. The deposit was struck at a depth of about 150 feet near the Whirlpool. It is what is known as "rock coal," but is burnable.

An Order-in-Council was recently passed prohibiting the export from Canada to all destinations (except under license) of the following: Ammonium sulphate, calcium carbide, bones and other materials entering into the manufacture of fertilizers, chemical and mechanical wood pulp, and platinum.

The Spruce Falls Pulp & Paper Company, of Toronto, some weeks ago secured from the Ontario Government the right to cut pulpwood on the Kapuskasing limit, on the understanding that $1,000,000 is to be spent in the erection of a ground wood pulp mill to manufacture 100 tons of pulp per day.

Norway has for some years been an important producer of molybdenite. Of the cost of production, Mr. E. R. Woakes, at a recent meeting of the Institution of Mining and Metallurgy in London, said, "no mine produces a ton of 75% concentrates at a less cost than $2,500 in Norway at the present time, with the abnormal cost of labor, materials, etc."

A bed of greensand has been discovered in Saskatchewan, and is being developed by Mr. C. E. Law, of Vancouver, who acts as Lord Rhonda's agent in Canada. Indications point to the existence of enormous deposits, and Mr. Law considers that for each foot of depth to the deposit every square mile underlain by glauconite will yield 78,000 tons of potash.

After months of experimenting with 600 German patents for manufacturing dyestuffs, the proper combinations of the patents for commercial production of dyes have been determined, and the Federal Trade Commission at Washington has granted the applications of E. L. duPont de Nemours & Company, of Wilmington, Del., and of the National Aniline & Chemical Company, of Buffalo, N.Y.

Carbonization of Canadian Lignites

By Edgar Stansfield, M.Sc., and Ross E. Gilmore, M.Sc.

(Concluded from January Number)

Vacuum Series

Eight completed tests were run in this series over a temperature range of from 355°C. to 705°C. The procedure differed from the regular in that the inlet tube of the retort was closed, and the outlet tube connected through a receiver to a good water pump; the pressure in the retort being thus kept below 25 mm. of mercury.

The results show, as was expected, that at any temperature the percentage of volatile matter driven off is greater than at ordinary pressures; but the difference is not so great as was expected. The calorific value of the residue is the same as in the regular series at 350°C., above this temperature it is distinctly less.

Steam Series

Six completed tests were run in this series over a temperature range of from 355°C. to 665°C. The general procedure was followed, except that a gentle current of steam was passed in through the inlet tube whilst the retort was being heated, dry coal gas being passed through as usual during the cooling period.

The results were similar to those of the regular and vacuum series up to a temperature of about 450°C. Above this temperature a secondary action appears to influence the results, this being very marked above 600°C. This disturbing influence is no doubt the chemical reaction, well known in connection with gas producers, between steam and carbonaceous matter, whereby carbon dioxide, carbon monoxide, and hydrogen are produced, and the yield and calorific value of the residue decreased. It is quite obvious that the results actually obtained in this series were dependent on the quantity of steam passed through and the duration of the heating. That fairly smooth curves were obtained was due merely to the fact that the quantity of steam and the time of heating were approximately the same in each case. If these had been sufficiently increased, at any rate at the higher temperatures, the coal would have been burned to ash.

TABLE II.

Summary of Results of Lignite Carbonization

Temperature of Carbonization °C.	Regular			Vacuum			Steam			Pressure		
	Yield of Residue	Calorific Value	Thermal Efficiency	Yield of Residue	Calorific Value	Thermal Efficiency	Yield of Residue	Calorific Value	Thermal Efficiency	Yield of Residue	Calorific Value	Thermal Efficiency
110	100.0	6,260	100.0									
200	96.8	6,485	100.3									
300	92.8	6,750	100.0									
350	87.4	6,920	96.6	86.3	6,920	95.4	89.8	6,850	98.3	86.0	6,960	95.6
400	80.5	7,110	91.4	79.6	7,045	89.6	81.0	6,970	90.2	79.0	7,205	90.9
450	74.2	7,280	86.3	73.5	7,170	84.2	72.8	7,090	82.4	73.1	7,400	86.4
500	70.0	7,435	83.1	69.5	7,280	80.8	67.8	7,200	78.0	68.4	7,575	82.8
550	66.8	7,530	80.4	66.5	7,355	78.1	63.4	7,285	73.8	65.0	7,640	79.3
600	64.2	7,520	77.1	63.7	7,365	74.9	58.7	7,255	68.0	62.8	7,595	76.2
650	62.1	7,470	74.1	61.5	7,315	71.9	49.0	7,000	54.8	60.9	7,550	73.4
700	60.8	7,390	71.8	59.8	7,230	69.1				59.2	7,515	71.1
800	59.1	7,270	68.6									
900	57.7	7,180	66.2									

NOTE.—The yield is the weight of the residue as a percentage of the moisture free coal. Calorific values are given in calories per gram of residue. The thermal efficiency is the heat value of the residue as a percentage of the total heat value of the original sample.

TABLE III.

Calculated Composition of Residue on Carbonization

Loss of Volatile Matter Dry Coal Basis	Total Loss of Weight Coal as Received	Composition of Residue			Calorific Value of Residue Calories per Gram
		Ash	Volatile Matter	Fixed Carbon	
0.0%	31.8%	7.6%	42.3%	50.1%	6,260
5.0	35.2	8.0	39.2	52.8	6,620
10.0	38.6	8.4	35.9	55.7	6,850
15.0	42.0	8.9	32.1	59.0	6,990
20.0	45.4	9.5	27.9	62.6	7,120
25.0	48.9	10.1	23.1	66.8	7,260
30.0	52.3	10.9	17.6	71.5	7,435
35.0	55.7	11.7	11.2	77.1	7,530
40.0	59.1	12.7	3.8	83.5	7,335
42.3	60.7	13.2	0.0	86.8	7,180

NOTE.—The calorific values are taken from the curve for the regular series of tests.

The calorific values shown in the curves were not determined immediately after the experiment. The results to be obtained are so dependent on the quantity of steam passed through, that it was not thought necessary to repeat this series according to the later standardized method. The yield curve is probably correct as it stands, but the calorific value curve, and the results deduced therefrom, are probably uniformly two or three per cent. too low.

Pressure Series

Eight completed tests were run in this series over a temperature range of from 335°C. to 685°C. The special retort described above was employed, and the general procedure was modified in that the retort was closed so that the volatile products could not escape. When the charge was first heated the pressure rose rapidly to above 120 pounds per square inch, but the relief valve being opened as required the pressure was reduced and maintained as close to that figure as possible. At the end of the experiment the retort was cooled with the valve shut.

Trouble was experienced in this series from the water in the coal. In the first place it volatilized and created a big initial pressure; and then, after this had been relieved by the valve, the steam still remaining in the retort gradually passed into the exit tube and condensed, causing the pressure in the system to fall below the desired minimum. In the second place, the steam in the retort reacted with the coal as described in the previous series, and masked the results it was desired to study. Seven experiments in this series were therefore carried out using coal briquettes previously dried in carbon dioxide in a toluol oven. In one experiment at 335°C. moist coal was used, the steam effect at that temperature being negligible.

The results are remarkable in that they agree most closely with those of the vacuum series. The calorific values, however, are distinctly higher than in any other series, reaching a maximum at about 550°C. and then rapidly falling off.

Commercial Significance of Results

Commercial methods for the carbonization of coal may be divided into two classes, intermittent and continuous. In the intermittent process coal is charged into a heated retort or oven, and the heating is continued, usually from the outside, until all the charge has been raised to the desired temperature and sufficiently carbonized. The residue is then removed from the oven and quenched, and a fresh charge inserted immediately whilst the oven is still hot. In the continuous process the coal is fed into the top of a vertical or inclined oven. The charge slowly passes down through the oven, becoming gradually heated as it approaches and passes through a strongly heated zone, then cooling off in the lower zone, and finally being discharged from the bottom. The rate of charging at the top and discharging from the bottom are so adjusted that the oven is always kept filled. This latter process is at present responsible for only a small percentage of the total world output of coke; but it appears to have many advantages for the carbonization of lignite or other non-coking coal.

The portion of a charge which is adjacent to the heating walls of an intermittent oven is rapidly heated to the temperature of the oven, but, because coal is a poor conductor of heat, the inner portions of the charge are only slowly heated. The whole charge is slowly heated in the continuous process. Ease of operation calls for large ovens; but an oven of large cross section on account of the slow transmission of heat through the charge, either involves a long heating period, which is expensive, or a big difference in final temperature between the outside and the inside layers of the charge. These difficulties may be overcome with non-coking coals by the use of inclined rotary ovens, the charge being thus kept stirred and uniformly heated; but such ovens have not yet become commercially established.

The regular and the slow series of tests were carried out to show what difference, if any, was caused by the rate of heating, and also what effect the final temperature had on the result—information which the above discussion shows to be essential for the correct design and operation of a lignite retort. The results so far obtained indicate little difference between rapid and slow heating, and point to nearly 600°C., as the most satisfactory temperature. They also show that if, in order to raise the centre of the charge to 600°C., the walls of the retort are heated to a higher temperature, a falling off in calorific value results. On the other hand, if the walls of the retort are heated to 600°C., the results can be employed to estimate both the higher volatile matter content, and the lower calorific value, to be expected in the successive layers approaching the centre of the charge, when the temperature gradient is known. Definite conclusions cannot, however, be drawn from these experiments, until information is also available with regard to the value of the by-products obtained under any given conditions.

An investigation begun by Pictet & Bouvier, of Geneva, in 1913, showed that the tar produced by distilling coal at a low temperature and pressure was markedly different from normal coal tar. The writers are not aware that any commercial advantage has yet been taken of this discovery, but it seemed important, nevertheless, to investigate the effect of low pressure in the carbonization of lignite. The results obtained in the vacuum series indicate that the temperature necessary for satisfactory carbonization cannot be notably decreased by the use of low pressure. More notable results are to be expected when the yield and nature of the by-products are also studied.

Serious trouble is experienced in the commercial carbonization of lignite on account of the great inflammability of the hot residue, and the difficulty of cooling it completely without access of air. The rapid change noted in the residues, even after cooling, has considerable significance in connection with this trouble. It is well known that when freshly prepared charcoal is first exposed in bulk to the air, it is liable to catch fire spontaneously, even if originally cold, owing to the heat generated by the occlusion of air; and the behaviour of carbonized lignite appears to be closely comparable. It is easy to see the advantage of the recently devised process of adding the necessary binder, which will fill the pores of the carbonized material, and then briquetting the whole before it is exposed to the air.

Carbonization in a current of steam was tried as a possible economical substitute for vacuum carbonization, in case the latter was found to be advantageous; the primary physical effect, which is the reduction of the partial pressures of the volatile products (except steam), being the same in each case. The use of steam would also have the advantage of driving the air from the retort at the beginning, and of helping to equalize the temperature throughout the charge. The results obtained however, show that steam could not satisfactorily be passed through the retort where the temperature was over 450°C. Furthermore, the results discussed above, in connection with the steam and pressure series, indicate the advisability of either subjecting the lignite to a preliminary drying before it is carbonized, or of withdrawing the steam and other gaseous products from the retort as fast as they are formed.

The supply of a suitable binder is probably the most serious economic difficulty in any process for the utilization of lignite, and it was in consideration of this problem that the pressure series was run. One process is to carbonize the lignite in such a way as to obtain the most valuable yield of by-products, the residue then being briquetted with the addition of the necessary binder. Another possible process is to carbonize the lignite in such a way as to necessitate the least possible addition of a binder for briquetting; the by-products, in contradistinction to the above, being given only secondary consideration. It was thought that vacuum carbonization would give the most valuable by-products, but that carbonization under pressure might cause a breaking down of the volatile matter in the lignite in such a way as to leave pitchy material in the residue, which would therefore require the addition of less binder than usual

for briquetting. It should be noted that in every case some pitch suitable for a binder could doubtless be obtained by distillation of the tar, but it is not anticipated that this will be sufficient in any case for briquetting all the residue obtained. The experiments so far carried out did not cover determination of any binding material present in the residue; but the results obtained showed that a residue of unusually high calorific value was produced, if the lignite was given a preliminary drying. Very few Canadian coals, as mined, have as high calorific value as the residue from pressure carbonization at about 550°C.

In conclusion, it may be stated that although all the above experiments were carried out on one coal, a few preliminary experiments in the regular series were carried out with a sample of coal from Tofield near Edmonton. The results, calculated to a moisture-free basis, showed a close agreement with those obtained from the Shand mine coal, thus indicating that the results of this investigation are generally applicable to low grade Canadian lignites.

Acknowledgments

The above investigation was carried out in the Fuel Testing Laboratories of the Mines Branch of the Department of Mines, at Ottawa, where a further investigation along the lines indicated is now in progress. The determinations of calorific value were made by Mr. R. C. Cantelo, B.Sc.

This paper is published with the permission of Dr. E. Haanel, director of the Mines Branch.

Foreign Trade Enquiries

[The names and addresses of the firms making these inquiries can be obtained only by those especially interested in the respective commodities upon application to "The Inquiries Branch, The Department of Trade and Commerce, Ottawa." In writing correspondents should quote the number of the enquiry. The initials, "B.T.C." indicate that the enquiry for the address should be directed to the British Trade Commissioner in Canada, 363 Beaver Hall Square, Montreal.]

151. An Australian commercial agent wishes to get into touch with Canadian paper manufacturers either to sell on commission or to buy direct. He particularly asks for brown wrapping papers on reels or flat and cap papers. Would be glad to handle other lines.

153. A London firm asks to be placed in communication with Canadian manufacturers of saccharin, from which he wishes to purchase supplies.

154. A London, England, dealer in iron and steel products and cast-iron pipes of all kinds asks to be put into touch immediately with Canadian manufacturers of cast-iron rainwater and soil pipes. For specifications and illustrations see pages 484-485 of this issue of the Weekly Bulletin.

155. An old-established firm in St. John's, Newfoundland, asks for the names of Canadian manufacturers of marbleized slate mantles or marbleized slate.

162. A Johannesburg, South Africa, firm asks for samples and quotations on colours ground in oil.

166. A South African manufacturers' agent, making a specialty of the drug trade, is prepared to take up the representation of any line suitable for the drug trade, wholesale and retail.

170. A South African manufacturers' agent, calling regularly on the trade, is prepared to take up the representation of Canadian paints and oils, also brushware. Immediate correspondence requested.

173. A Cape Town firm of electricians asks for samples and quotations on 3½ inch wood blocks, stained walnut. Other particulars may be obtained from the Department of Trade and Commerce.

182. An English firm would be glad to hear from Canadian growers or shippers of the following medicinal plants and drugs, which they could handle in fairly large quantities; senega root, sassafras root and bark, bloodroot, podophyllum rhizome, cimicifuga, hydrastis rhizome, slippery elm bark, witch hazel bark and leaves, wild cherry bark, enonymus bark, castor, Canada balsam.

184. Sulphuric acid, carbonic acid gas and anhydrous ammonia. A firm in St. Kitts, with an aerated water factory desires to import the foregoing products.

185. A firm in St. Kitts, British West Indies, requests to be put in touch with Canadian manufacturers of lubricating oils.

188. An old firm in St. Lucia, British West Indies, asks to be put in touch with Canadian exporters of sulphate of ammonia.

189. A firm in Barbados, British West Indies, manufacturing aerated waters, would like to import sulphuric acid from Canada.

201. A Johannesburg commission house, with branches in each coast town and long experience in handling carbide, is prepared to take up the representation of Canadian carbide. Immediate correspondence requested.

206. A Johannesburg house, specializing in iron and steel for structural purposes, seeks the representation of a Canadian firm.

209. A Rhodesian manufacturer asks for quotations on carbon electrodes for the manufacture of carbide. Sizes required are 6 inches to 12 inches wide and 12 inches long.

210. A Salisbury, Rhodesia, producer asks for catalogues and full details of machinery plant for the production of alcohol from sweet potatoes, corn, corncob and cornstalk.

213. A South African firm of manufacturing chemists will be pleased to hear what Canada can offer in chemicals, especially those for pharmaceutical purposes.

224. Paints and varnishes, fencing and baling wire, wire netting, iron and steel goods, hardware, lanterns, cutlery, enamelware, shovels, tools of all kinds, furniture, foodstuffs, and grocery proprietary lines. A South African wholesale firm requests catalogues and price lists, also samples when possible of the above lines. These are mentioned in a special way, but they are interested in any line of goods suitable for the wholesale jobbing trade. The furniture must be of a kind which can be shipped in a knocked-down condition.

264. Genoa varnish manufacturer is desirous of purchasing crude celluloid (uncolored).

265. Indigo, logwood extract, chemicals, engineering sundries. Palmero commission merchant is anxious to import the above.

268. Commission agent at Genoa wishes to represent British firms: Mild steel for shipbuilding, emery cloths and wheels, engineering sundries, cutlery, tools, belting, glass paper. (N.B. fluent English).

270. Representative (Genoa) would handle on commission chemicals, soap, hides, etc.

271. Import and export agents at Genoa wish to represent British firms: Chemicals, foodstuffs, etc.

274. Turin firm wishes to import on own account or commission: Chemicals, industrial sundries, pharmaceutical and dyeing requisites, woollen piece-goods.

293. Chocolate, colonial and medicinal products, essences for confectionary. Merchant at Naples is interested in the above.

295. Agencies are desired by a Florence merchant for hardware, colors, varnishes, chemicals, soaps, essential oils, perfumery.

The Ontario Government has protested to the British-American Nickel Company against their establishing their proposed nickel refining plant in Quebec, and are urging the company to locate the new works in the Province of Ontario. The difficulty hinges on the supply of hydro-electric power.

An important deposit of manganese at Kaslo, B.C., has been sold to Seattle capitalists. The development of this deposit will furnish one of the essentials in the manufacture of high-grade engineering steel.

The capital stock of the International Nickel Company of Canada, Limited, has been increased from five million to fifty million dollars.

Montreal Letter

(From Our Own Correspondent)

MONTREAL, QUE., April 29, 1918.

The Chemical and Metal market is very much restricted in its functions, largely through inability to get supplies. The recent embargo by the United States Government on certain chemicals, together with the licensing of dealers, freight troubles, etc., have further complicated matters. Dealers state that price is less of an obstacle than the matter of supplies. Apparently men who use chemicals in their business, like those in other lines of industry, have become accustomed to high prices and are willing to pay reasonable advances. The question of supplies, however, is a real fly in the ointment. Owing to this uncertainty in regard to securing materials, there is a certain amount of hand-to-mouth buying,—especially is this true of industrial chemicals. Chemicals used in the drug trade are also scarce and prices are continually mounting to new high levels. In some cases substitutes are being discovered and utilized in place of the old favored drugs, but in other cases people are simply getting along without materials.

An interesting case came up before a Montreal Military Service Judge a few days ago. C. Fortier, a chemical engineer, and manager of the Chemical Works of Canada and a director of the Fortier & Dissy Glass Factory, was granted exemption because his work was of national interest. Mr. Fortier was able to show that he had invented a new chemical which replaced ether in the bleaching of paper and also that his firm was supplying wholesale houses and hospitals with needed chemicals. Owing to the claims put forth, Mr. Fortier was granted exemption as long as he remained in his present employment.

The development of the water powers on the St. Maurice River, centering very largely around Shawinigan Falls and Grand Mère, have made this district one of the most, if not the most important manufacturing centre in the Dominion. Recently Mr. J. E. Aldred, president of the Shawinigan Water & Power Company, and Mr. Charles R. Hosmer, vice-president of the Laurentide Company, Limited, announced that plans were under way for a largely increased development of the water powers in the district. They stated that after negotiations with Mr. C. A. Magrath, the Fuel Controller, the various power companies operating in the St. Maurice district, intended to develop so much additional power that they would save from 100,000 to 150,000 tons of coal per annum, or, in a money sense, a saving of from $1,000,000 to $1,500,000. Mr. Aldred announced that as a result of the promised development, a new industry was being brought to the district, viz., the Ferro Alloy Company, who will manufacture a product which enters into high grade steel products employed in the manufacture of automobile parts, etc. At the same time Mr. Aldred announced that arrangements had been made with the United States for the erection of an Acetic Acid plant, which would be financed by the United States Government. This industry involves the outlay of $1,500,000. Already the Electro Products Company, with Dr. John S. Bates, formerly head of the Forest Products Laboratory of McGill, in charge, is making acetone and acetic acid at their plant on the St. Maurice. The new United States Government acetic acid plant will be an exact duplicate of the one now being operated under Dr. Bates. It is also said that there is a likelihood of a plant being established there to manufacture Sodium Acetate.

An interesting talk on "Shawinigan Power and Its Uses" was given a few days ago by Mr. H. E. Randall, of the Shawinigan Water and Power Company. He spoke before the members of the Montreal Electrical Association and gave a very interesting talk on the Electro-Chemical activities of the Shawinigan Company and its transmission of power.

The Hon. Alphonse Racine, head of the wholesale drygoods firm of A. Racine & Company, has been made Fuel Controller for the Province of Quebec. He will work under Mr. Magrath. An important part of Mr. Racine's work will be to bring about an increase in the development of the water powers in this province, with the idea of saving coal.

The importance of conserving coal and utilizing the water powers that are going to waste was further urged by Mr. A. M. Beale, of the Water Power Branch of the Department of the Interior, in an address delivered before the Westmount Canadian Club. He pointed out that Canada had 18,000,000 horse power, but that only one-tenth of this had been developed. By developing our water power resources we would economize in coal, help to readjust adverse balances of trade by developing home industries, and by refraining from sending so much money to the United States for coal relieve the railway congestion, and in many other ways improve our economic condition.

That the power possibilities of the St. Lawrence are of the utmost importance is still further shown by an article in a recent issue of the Commission of Conservation Bulletin.

Mr. Arthur V. White, consulting engineer of the Commission, has an article on the power possibilities of the St. Lawrence River, in which he points out that almost unlimited horse power is flowing unused to the sea.

During the month of March liquor companies in Montreal did a land office business shipping all kinds of liquor to Ontario. Despite the volume of business they handled, there still remains large stocks on their hands, while the breweries and distilleries in the province are at a loss to know where they can find a market for their output. Some of these are now considering the advisability of changing their plants so as to manufacture alcohol for industrial purposes.

The first meeting of the associate committee on mining and metallurgy of the Council for Scientific and Industrial Research, has been held in Montreal. This meeting brought together the leading technical men in these subjects from all parts of the Dominion, and steps were taken at this meeting for the further development of certain of the mineral resources of the Dominion and for the utilization of a number of waste products which are being developed in Canadian industries.

The meeting resulted in definite action being taken on certain projects which were discussed. Among these is the investigation of a new method of smelting iron, employing both coke and electric power. This promises to be especially suitable for the smelting of certain Canadian ores occurring in the vicinity of large supplies of available water power. The Research Council has already made a grant for the prosecution of this work, and the preliminary investigations will at once be carried out at McGill University for the development of a commercial process for the production of high grade domestic fuel from sawdust. This is now being produced on a small scale in British Columbia, but it is believed that it may be capable of development to great advantage in other parts of the Dominion where there are large amounts of refuse sawdust and wood now being wasted.

The utilization of refuse from sheet steel and galvanized iron, of which large amounts are now waste products in various factories of the Dominion.

Leslie R. Thompson, B.Sc., C.E., who is at present on the staff of the Dominion Bridge Company, has been appointed as secretary of the Honorary Advisory Council for Scientific and Industrial Research, and has already entered on his duties.

With regard to the paragraph in our March number referring to the Manitoba Steel and Iron Works we are informed that the Manitoba Bridge and Iron Works will be carrying on business as heretofore, the only difference being that the merchandising business in steel and iron plates, bars and such material which they were conducting in connection with the manufacturing business will now be handled by the Manitoba Steel and Iron Company.

Photo Engraving by the International Press, Ltd.

Meurig Lloyd Davies

Mr. M. L. Davies, vice-president of the Standard Chemical, Iron and Lumber Company of Canada, Limited, was born in Liverpool, England, in 1865. Mr. Davies was educated at Liverpool College, and upon completion of his studies entered the service of James Muspratt & Sons, chemical manufacturers, of Liverpool, where his talent and energy were recognized by his appointment as manager of the company's Liverpool works. This company was absorbed by the United Alkali Company, and three years later Mr. Davies was promoted to the management of the Hutchinson works of that corporation at Widnes, Lancashire. In 1899 he came to America, and was appointed manager of the business of the North American Chemical Company at Bay City, Mich., in which the United Alkali Company are interested. Here he took up the problem of the electrolytic production of chlorates of potash and soda and incidentally the manufacture of salt as a by-product. He also had the management of the company's coal mines which were located near Bay City. During the last five years of his residence in the United States, he was a director of the First National Bank, Bay City, and because of his interest in the social welfare of the community, was elected president of the Civic League of that city.

In 1913 Mr. Davies came to Canada and was appointed general manager of the Standard Chemical, Iron and Lumber Company, manufacturers of hardwood distillation products, and in the same year was elected vice-president of this corporation, which office he occupies now. While with the United Alkali Company, he devoted much study and work to the production of pure acids, including sulphuric, hydrochloric and acetic, and the Canadian company has reaped the benefit of his experience in England.

Mr. Davies is a member of the American Chemical Society, as well as of the Society of Chemical Industry, in the progress of the Toronto Section of which he has always taken a whole-hearted interest since he came to Toronto.

He is still associated with the United Alkali Company, and is a director of several other companies, including the Port Hope Sanitary Manufacturing Company, the North American Chemical Company, and the Robert Gage Coal Company, of Bay City.

Volumetric Method for the Determination of Mo. in Ferro-Molybdenum

By H. C. Mabee, Department of Mines, Ottawa

In a nickel crucible fuse 1 gram sodium carbonate and run the fusion well up on the sides. Cool, and place 5 grams sodium peroxide in the crucible and into this weigh ½ gram of the ferro sample.

Mix with a glass rod, brushing any adhering matter into the crucible and then cover with a sprinkling of the peroxide. Fuse with a low flame for about five minutes, then raise the temperature and remove the lid, keep the fusion at a cherry red heat for a few minutes, rotating the fusion. Replace over the flame and again raise to red heat for about three minutes. Cool, running the melt well up on the sides as before.

Place the crucible upright in a covered 400 c.c. beaker containing about 150 c.c. of water, then with a stirring rod tip the crucible on its side, when the melt is leached out rinse off the cover glass, remove the crucible and work well with hot water. Add 4 grams of ammonium carbonate and boil for ten minutes. Allow to settle and filter through a 12.5 cm., No. 3 Whatman filter. Wash well with hot water. To the filtrate add 20 c.c. concentrated sulphuric acid and boil for fifteen to twenty minutes to drive off carbon dioxide and dissolved oxygen.

Dissolve the precipitate in 25 c.c. dilute sulphuric acid, make up to 150 c.c. and again precipitate the iron and nickel with 30 c.c. of 50 p.c. caustic soda solution, filter and wash well. Acidify the filtrate with 15 c.c. concentrated sulphuric acid.

Reduce both solutions separately by passing through a zinc reductor into a gas bottle containing 40 c.c. of 10 p.c. ferric ammonium sulphate solution, and 20 c.c. "titrating mixture." Titrate the reduced iron to a faint pink with permanganate. The value of the permanganate in terms of MoS_2 multiplied by 0.6 equals the Mo value. The precipitate of iron and nickel may be reserved for the estimation of iron.

High Tension Phenomena

One hundred and ten members of the Toronto Section of the American Institute of Electrical Engineers, were last month privileged to see demonstrations of testing at 250,000 volts, the use of the sphere gap, for measuring high voltages and the formation of corona, at the Hydro Electric Laboratories, Toronto. The occasion was that of a paper by Mr. W. P. Dobson, on "High Voltage Phenomena." The test demonstrated the reliability of the sphere gap in comparison with the needle gap for measurement at different frequencies. It is thought that considerable work might be accomplished in the Commission's laboratories in standardization and research at high voltages.

Mr. O. B. J. Fraser, of New York, is coming to Canada to take up work with the International Nickel Company at Port Colborne, Ont.

Owing to the work of reorganizing the Inland Revenue laboratory at Vancouver, Mr. J. A. Dawson, chairman of the Canadian Pacific Section, Society of Chemical Industry, regrets that he will be unable to be present at the Ottawa convention of chemists.

Dr. G. H. Brother, formerly of the staff of the chemistry department, University of Toronto, and more recently attached to the Inland Revenue Department, Ottawa, as public analyst, has accepted the position of chief chemist to the Atlantic Loading Company, 67 Broadway, N.Y. This company is at present engaged on large shell filling orders for the United States Government.

Canadian Government Publications

By L. E. Westman, M.A., Inland Revenue Department, Ottawa.

[NOTICE.—Recent Government publications of scientific, technical, or educational value, are reviewed here from month to month. Unless otherwise stated these publications may be obtained free, by those interested, upon application to that department of the Government issuing the same.]

Department of Interior

WATER POWER BRANCH—

Water Resources Paper No. 21. British Columbia Hydrometric Survey for the Calendar Year 1916, by R. G. Swan, pp. 362. Hydrometric data and meter measurements are given. Areas reported upon comprise the four divisions of Kamloops, Coast, Nelson, and Fort George, and districts within these limits.

Department of Naval Service and Fisheries

FISHERIES BRANCH—

Contributions to Canadian Biology being Studies from the Biological Stations of Canada, price 15 cents, 173 pp. An account of studies made by a number of leading professors of Animal Biology and Zoology, on Canadian Fish. Seventeen papers are given; seven are zoological and have a practical bearing upon our fisheries. Four of them relate to fish culture, especially lobster, oyster and shellfish culture generally. Two are botanical and chemical in nature. A list of titles follows: (1) Pacific Halibut Fisheries, Prof. Willey; (2) The Egg of the Halibut, Prof. Prince; (3) British Columbia Kelp Beds, Prof. A. T. Cameron; (4) Government Lobster Pond, N.S., Prof. Knight; (5) Barren Oyster Bottoms, P.E.I., A. D. Robertson; (6) Supposed Disease of Quahaugs in N.B., Prof. Cox; (7) Herring Disease, Prof. Cox; (8) Life of the Hake, A Scale Study Mr. Craigie; (9) Growth of the Haddock, A Scale Study, Miss Duff; (10) Growth of the Cod, A Scale Study, Mr. Wodehouse; (11) Deterrent Effects of Light on Migrating Eels, Prof. Cox; (12) Possible Areas for Lobster Breeding in B.C., Dr. Fraser; (13) Variations in Density and Temperature in B.C. Waters, Prof. Cameron and Dr. Fraser; (14) Physical Studies in New Brunswick Bays, Mavor, Craigie and Detweiler; (15) Hydrographic Section of the Bay of Fundy, H. Craigie; (16) Iodine in Certain British Columbia Kelps, Prof. Cameron.

Biological Board of Canada, Bulletin No. 1. The Canadian Plaice, 1918. A. G. Huntsman, University of Toronto Press, price, 15 cents. 32 pp. This is the first of a series of bulletins dealing with our food-fishes. Each issue will consist of a simple presentation of facts bearing upon one of the various problems presented by our fisheries. It must be pointed out that although it may be true that we have the greatest fisheries in the world we have not made the greatest use of them as yet. This pamphlet deals with the distribution and life history of the Plaice alone and several million tons might be obtained annually on our Eastern Coast line. This fish is found at depths of from 20 to 100 fathoms and is best fished in the southern part of the Gulf of St. Lawrence. At present it is not utilized to any extent in Canada.

Commission of Conservation

Conservation in 1917. The address delivered by Sir Clifford Sifton before the Ninth Annual Meeting of the Commission of Conservation in pamphlet form. A comprehensive review of the progress made in conservation of natural resources in 1917.

A Hand Book for Farmers. For farmers only. Deals with tillage, use of manures, seed selection, clover growing, the farm garden, weed and insect pests, in an informative and popular manner.

Peat as a Source of Fuel. Eugene Haanel. Reprint from Ninth Annual Report. Dr. Haanel deals in some detail with the difficulties which have beset the introduction of peat as a fuel in Canada. Fifty-eight peat bogs have been located and studied, twenty-five of these are in Ontario and twelve in Quebec. They could produce 115 million tons of fuel. The real problem for the peat engineer is the removal of the 86% water found present. The only economic process for doing this is by wind and sun drying. When dried down to 20 to 25% moisture content the peat becomes very resistant to the reabsorption. This is due to a "colloidal skin" forming on the outer surface. To be of value a bog must be conveniently situated with respect to an industrial centre. One whose nitrogen content is high should be used in by-product-recovery-producers for generating industrial and power gas. Electrical energy could be economically generated at such a bog, while sulphate of ammonia might also be produced. It is to be pointed out that the usual methods of exploiting natural resources will not work when applied to a case of this kind. Only very careful planning by qualified engineers and men of special experience in these lines can hope to meet with any measure of success.

Department of Inland Revenue

Bulletin 378. Fertilizers for 1917. Annually, under the Fertilizers Act, all commercial fertilizers on the Canadian market are examined and results of analysis printed. Their nitrogen, phosphorus, and potash content is reported upon. In 349 samples collected only 12 were found to be slightly below their claims. Each year since the war shows a decrease in the number of fertilizers claiming to contain potash.

Bulletin 386. Cascara Sagrada. L. E. Westman and R. M Rowat. A study was made of the composition of aromatic and fluid extracts of this drug as sold in Canada. Complete analytical data is presented on 76 samples and partial data on 162. Data on the following determinations and a discussion of their value is given. (1) specific gravity; (2) alcohol; (3) total solids; (4) solids precipitated on dilution; (5) reducing sugars; (6) licorice, glycerin, aromatics; (7) ash; (8) manganese number; (9) color reactions and like tests. The determination of manganese in such extracts is new and opens up a new method for their valuation. In aromatic extracts, glycerin and licorice seem to have unduly displaced the official cascara content.

Bulletin 387. Beans. For some time certain varieties of Oriental beans having a fairly high prussic acid content have been coming into this country. In June, 1917, a limit of 20 parts per 100,000 was set for prussic acid. The United States limit being uniformly lower than this the Canadian market has been well stocked with this product. From Vancouver to Winnipeg these imported beans practically monopolize the market. They do not mature when planted in our climate, but when properly cooked by prolonged soaking and boiling the prussic acid passes off, being volatile in steam. In a general collection of 532 samples only 19 were found to contain more than the legal limit of prussic acid.

Bulletin 392. Sausages. A discussion of the commercial practice in the manufacture of sausages is given as well as Departmental Standards for this article. In the Montreal district an abnormal condition was found in respect to the use of dyed sausages. Seventy per cent. of the samples taken in this district were found to contain dyes. Only 4 samples in 123 collected in other parts of the country were dyed.

Department of Agriculture

Agricultural Instruction in Canada, 1913 to 1917. A review of the work performed by the provinces with the moneys granted under this Act. During this period $500,000 was distributed on the basis of population to supplement provincial grants. The work involved in stimulating various agricultural industries is detailed.

Monthly and Miscellaneous Publications

Agricultural Gazette of Canada. Monthly, $1.00 per annum. Deals with the work under way in various branches of agriculture.

Unrevised Monthly Statement of Imports and Exports, Department of Customs. $1.20 per annum. Detailed information relative to the export and import of chemicals and drugs.

Weekly Bulletin, Department of Trade and Commerce. Commercial Intelligence Branch. For Canadian distribution only. Foreign trade reports and trade openings for Canadian products.

Labor Gazette, 20 cents per annum, Department of Labor. A recording thermometer denoting movements in trade for the month.

Conservation. A monthly bulletin from Commission of Conservation. Articles always of interest to any technical man or chemist.

Canadian Food Bulletin. Published every two weeks. A pamphlet designed to give information and secure cooperation in the vital work of conserving and using our available food supplies to the best advantage.

Report of the Food Controller. Hon. W. J. Hanna, K.C. An account of the work begun and carried out by the Food Controller up to February 1, 1918.

Recent Canadian Patents

Of Interest to the Chemical and Metallurgical Industries

180,964. An Alloy, characterized by a high degree of hardness, toughness and resistance to oxidization. The Union Carbide Company of Canada, Welland, Ont.

181,179. Process for preparing vegetable charcoal. Alfred H. Bonnard, London, England.

181,252. A process for making citrate soluble phosphates. Jacob J. Lipman, New Brunswick, N.J.

181,287. A method of producing a catalyst by a process of reduction. Nathan Sulzberger, New York City.

181,354. Recovering pure oil from lubricating oil by a process of agitating with a heavier body of liquid containing a phosphate solution. Chas. J. Skidmore and Peter F. Conerty, New York City.

181,414. An electro-plating apparatus, with tank for the electrolyte, anode and cathode supports. August Leuchter, Brooklyn, N.Y.

181,426. Methods of producing toluene and propane by heating spruce turpentine in the presence of aluminum chloride and distilling the resultant liquid. Ralph H. McKee, Ridgefield Park, N.J.

181,447. Process for reducing metal compounds by treating with hydrazin in the presence of a catalytically acting metal, thereby producing a non-pyrophoric catalyst. Nathan Sulzberger, New York City.

181,457. A non-freezing compound consisting of a mixture of calcium chloride, borax, glucose and water in varying proportions. The Adams & Elting Company, Chicago, Ill.

181,460. A method of making rubber compounds by the addition of an aniline oil and petrolatum, so as to produce elasticity and smoothness. The Canadian Consolidated Rubber Company, Limited, Montreal.

181,461. Method of curing rubber articles by subjection to the action of sulphur chloride and an aniline solution, thereby neutralizing the acids in the rubber. The Canadian Consolidated Company, Limited, Montreal.

181,464; 181,465. The production of phenolic condensation compounds by mixing a phenolic body and a methylene body and subjecting the mixture to a process of heating, elimination, and the incorporation of a cyclic compound. The Redmanol Chemical Products Company, Chicago.

181,477. Process for producing aluminum carbide by passing a continuous electric current through a charge of aluminum and carbon. The Standard Oil Company, New York.

181,513. An improved method of fermenting lyes by treating cellulose and the like with acid solutions. A. V. Jernberg, Fidaholm, Sweden.

181,522. Process of hardening and tempering copper by plunging the heated metal into a partly neutralized bath. John A. Morterud, Duluth, Minn.

181,551. Making paints by mixing a pigment in water, lead linoleate and linseed oil with acid content. The Sherwin-Williams Company of Canada, Montreal.

181,571. The conversion of ferrous phosphates in aqueous solution to ferric phosphates by contact with air. Wm. H. Allen, Detroit, Mich.

181,639. An adhesive waterproof composition of silicate of soda, blood, and ammoniated water. Wm. W. Wood, Tacoma, Wash.

181,644. A lubricant consisting of an asphaltic oil and a parafin oil prepared by heating the mixture and blowing air through it. The Crew Levic Company, Philadelphia, Pa.

181,647. An improved process of reclaiming the dye contents of waste dye liquors by neutralizing and filtering. The Forsyth Dyeing Company, New Haven, Conn.

181,655; 181,656; 181,657. Methods of producing acetaldehyde from acetylene by treating with acids and acid salts. The Union Carbide Company, of Canada, Limited. Welland.

181,761. Method of recovering volatile metallic values from molten slag or the like by vaporization and oxidization. Herman Witteborg, Caldwell, Idaho.

181,770. The manufacture of a leather-like material by impregnating fibrous material with a compound of linseed oil and a rosinate and then oxidizing same. The Canadian Consolidated Rubber Company, Limited, Montreal.

181,771. Process of dyeing a fibrous base and then impregnating with a composition containing resin, oils and a drier. The Canadian Consolidated Rubber Company, Limited, Montreal.

181,928. A glass containing varied percentages of silica, alumina, boric and sodium oxide. The Corning Glass Company, Corning, N.Y.

181,950. Process for distilling and recovering the metal content of ores by means of heat and electricity. David B. Jones, Chicago, Ill.

181,951. The recovery of manganese from their ores by the use of sulphuric acid and heat. Edward W. Haslup, Bronxville, N.Y.

Lapsed Canadian Patents

Reported by Hanbury A. Budden, Research Bureau, Montreal

The following Canadian patents lapsed during the month of March, 1918, for non-payment of renewal fees:

No. 138,915. Liquid Purification, Neff & Brandes, Germany. Passing over aluminium in a thin stream.

No. 138,925. Preserving Meats. Ahrens, Germany. Dipping repeatedly into hot fat.

No. 139,044. Wood Impregnation. Marmetschke, Germany. Injecting solution of zinc chloride and aluminium sulphate at 55°C.

No. 139,045. Submarine paint. Terrisse, Switzerland. Copper and cupric chloride to form cuprous chloride in nascent state and a waterproof varnish.

No. 139,049. Liquifying gases. Wolf, Switzerland. Cooling distillation gases by expansion of compressed hydro-carbon fluid and introducing expanded gases into uncooled distillation gases.

No. 139,100. Oil and pigment. Enequist, New York. Dissolving petroleum tailings in a light hydro-carbon oil, separating precipitate from oil.

No. 139,164. Producing Constant Electric Discharges in Gases. Kock, Sweden. Heating gases by an electric arc and passing them between annular electrodes through electric discharges.

No. 139,269. Converting Yeast into Food. Nolf, Belgium. Maintaining yeast at temperature between 45° and 60°C. till peptones have disappeared.

No. 139,283. Artificial Fuel. Shedlock, England. Powdered fuel and liquid hydro-carbon mixed and heated and agitated in gas tight chamber and then briquetted.

No. 139,339. Destroying Waste of Soda Pulp. Sandberg, Sweden. Spreading in thin film or surface of externally heated vessel and continuing distillation in heated screw feeders.

No. 139,342. Nickeling Aluminum. Chirade, France. Washing in bath of water and cyanide of potassium, immersing in hydrochloric acid, water and chloride of iron and depositing nickel in electric bath.

No. 139,363. Fertilizer. Coates, U.S. Calcining mixed calcium phosphate and calcium carbonate slaking and neutralizing calcines with sulphuric acid.

No. 139,413. Disinfecting Hides and Skins. Rohm, Germany. Treating with solution of complex copper salts before placing in tanning liquor.

No. 139,424. Wet Dressing of Sulphide Ores. Smith, Sydney, N.S.W. Apparatus consisting of series of inclined tables and drowning boxes.

A Chemical Shorthand

By Ingo W. D. Hackh

The expression of a fact in a simpler and yet accurate way is always a progressive step. In the writer's opinion a chemical shorthand for organic formula, which takes account of the structure and optical activity, is undoubtedly a time-saving device. The chemical shorthand for organic formula, as presented in the following pages, has a few advantages worthy of notice. Some of these are:

1. The design for each structural formula of a compound is a distinct picture, which helps to remember the structure of a compound.
2. By following the rules of the shorthand, it will be impossible to write for a given compound a structure which is not theoretically correct.
3. The shorthand is precise and clear. Mistakes cannot occur by following the simple rules, for each picture designates one and ONLY one definite compound.
4. Besides the structure, its optical activity can also be expressed.
5. No abbreviations are used.

It was about three years ago that the writer read in the Denver Medical Times a short paper on a chemical shorthand by Dr. Henry S. Denison,* and ever since felt that these suggestions should not be lost, but brought to the notice of chemists. A letter written to Dr. Denison was answered by his widow and the only material available was therefore the above mentioned paper, which has been elaborated in the following.

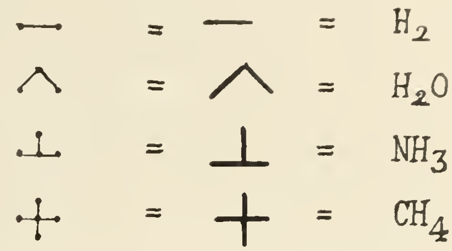
The system of the chemical shorthand is very simple and a half an hour of careful work will be sufficient for understanding and using it. It takes into account the four elements: H. O, N and C, while all other elements are represented by their symbols. The atoms of these four elements are thought to be points, from which one, two, three or four lines, respectively, radiate, representing accordingly the valencies, the lines representing the bonds:

HYDROGEN OXYGEN NITROGEN CARBON

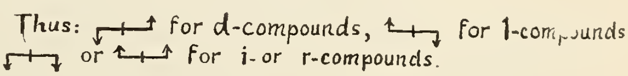
Thus a Hydrogen atom is assumed to stand wherever a line terminates. Oxygen is supposed to exist wherever a line makes an angle, or two lines come together. Nitrogen exists at the point where three lines arise, and Carbon exists at the point where four lines radiate, or two lines cross each other.

*Denver Medical Times, 31, p. 360, 1912.

The points are not marked in the shorthand, but determined by the lines, which may be straight or curved, and whenever a line meets, or crosses, or terminates, at those points the respective atoms are supposed to exist, we have therefore:



With these simple elements all organic structures can be accurately represented, and the pictures are so to speak the Valence-structures. Figure 1 and 2 gives a few examples of the aliphatic compounds. It will be noticed that the =CO group should be spearshaped, but can be represented by a loop (this being the only inaccuracy). Optical activity is expressed by writing the -C-OH group in such a way that the tail points in the direction of the plane of polarisation, that is the tail will point in the direction of the clock-hand movement when the compound is levorotatory, and in the opposite direction, when it is dextrorotatory. The directions of the tail will balance each other by inactive or racemic compounds.



The double bond is best written by a curved line, and the benzene ring, while already a shorthand device, would be written as a ring with three arcs, thus creating six C-atoms and 6 H-atoms, as in Fig. 3.

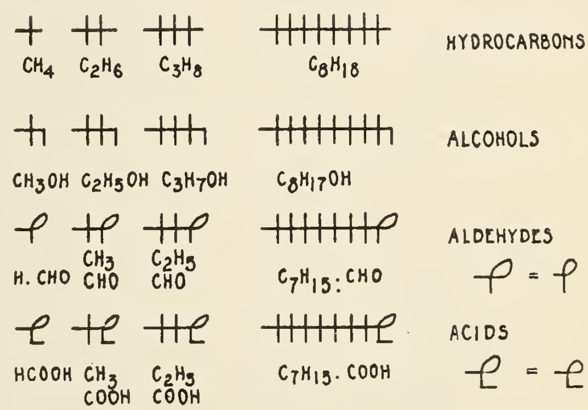


Fig. 1

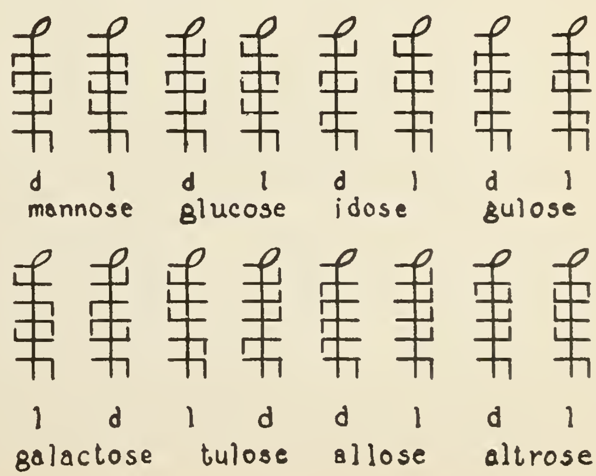


Fig. 2

In Fig. 4 finally the aminoacids of the proteins have been written, and the writer claims that the shorthand, as demonstrated, will not only enable the student of organic chemistry to get a precise and definite picture of the structure of the compound, which sticks to the memory, but that this way of writing structural formulas will be of great help in abstracting, where many times the same structure, with only slight modifications, occur. It has the great advantage of compactness, for it would have taken, for example, one or more pages each to represent the structure formulas of the carbohydrates or aminoacids, and aromatic compounds, which have been brought together in a narrow compass. It will be noticed that in one of the aminoacids (cystine) S occurs, which is then represented by its symbol, also in another figure Fe.

The rules for this shorthand are very simple, and the student is easily made familiar with them. The writer has employed this method in one of his classes with success and will feel that his labor has not been in vain if these suggestions should prove of value to other chemists.

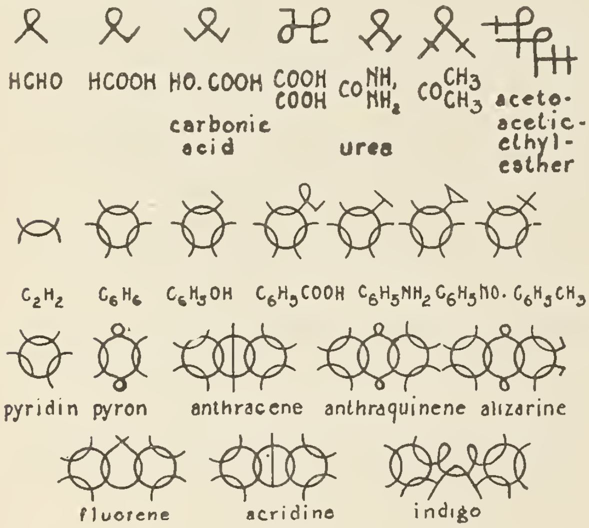


Fig. 3

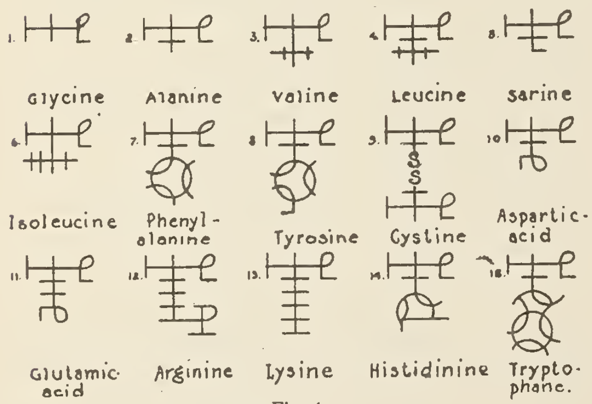


Fig. 4

Death of Prof. Haycock

The death of Ernest Haycock, professor of geology at Acadia College, took place at Wolfville, N.S., on April 13th, as the result of an attack of heart trouble. Professor Haycock was born in Westport, N.S., in 1867. He graduated from Acadia University in 1896, taking his M.A. degree two years later at Harvard University. He was then appointed professor of geology and chemistry at Acadia University, which position he held until 1912, when his work was divided, he retaining the professorship of geology. He had done considerable work in connection with the Canadian Geological Survey, and was well known as a learned geologist and a successful teacher and writer on geological subjects.

Determination of Barium in Barite by a Volumetric Method

John Waddell, Ph.D., D.Sc., Chemical Laboratory, Queen's University, Kingston

The increase in the production of barytes which was lately more than doubled in twelve months and again more than doubled in the next twelve months in the United States, and is also extending considerably in Canada, lends a little extra interest to the work recently done in my laboratory, for the purpose of testing a method of determining barium volumetrically, by dissolving the chromate in hydrochloric acid and after addition of potassium iodide titrating the iodine set free, with sodium throsulphate.

I thought of this method owing to the success of a somewhat similar method for the determination of lead, which I worked out several years ago (Journ. Ind. Eng. Chem., 3, 638 (1911). Some of the details are naturally different, though the chemical principles involved are similar.

My own experimental work was mainly checking over the results obtained by the students. When, for instance, men whom I expected to be able to carry out the operation accurately, unless there were some disturbing factor, obtained different results I worked with them, running through various tests and sometimes a complete determination in order to discover where the difficulty lay. Most, if not all of the figures in this paper were those of students.

The principles involved in this procedure are exhibited by the following equations:

$BaCl_2+K_2CrO_4=BaCrO_4+2KCl$

$2BaCrO_4+16HCl+6KI=2BaCl_2+2CrCl_3+8H_2O+3I_2$

$2Na_2S_2O_3+I_2=2NaI+Na_2S_4O_6$

While the principles involved are simple, the details of the operations are important. For example, the hydrochloric acid used to dissolve the chromate must be nearly cold and must be dilute else chlorine will be set free. Though the acid must be dilute, there must be a large excess, or the reactions after addition of potassium iodide will be too slow.

Hillebrand, in the bulletin of the U.S. Geological Survey, on the analysis of silicate and carbonate rocks, separates barium from strontium by precipitating barium with ammonium dichromate and weighing the barium chromate after ignition; and our first determinations were made with ammonium dichromate. We changed to potassium chromate, simply because the ammonium dichromate in the laboratory was found to be impure, while the potassium chromate was pure. I have no doubt that ammonium dichromate would do perfectly well.

The analysis is carried out as follows:

After fusion of approximately 0.2 grms, of barite with sodium carbonate, leaching out with water and filtration, dissolve the barium carbonate in the necessary quantity of dilute hydrochloric acid either on the filter, or after ignition of the filter and precipitate and removal of the ignited material to a 250 cc. Erlenmeyer flask. In either case dilute the solution to about 50 cc. in the flask and add 10 cc. of a 10% solution of potassium chromate. Heat the liquid nearly to boiling and add dilute ammonia, till a quite perceptible precipitate remains undissolved after thorough shaking. Then add 10 cc. of a 30% solution of ammonium acetate and boil for a minute or two while giving the flask a swirling motion.

As soon as the contents of the flask are cold, filter through a Gooch crucible with an asbestos mat. (Where filtration through a Gooch crucible is mentioned in this article, filtration in the ordinary way through paper, while not so convenient, may be employed with the necessary modifications). Wash with cold water till the washings give only a slight cloudiness with barium chloride. Barium chromate is slightly soluble in water, and according to Seidell, a little more soluble in ammonium acetate solution and probably washings would continue indefinitely to give a faint cloudiness with barium chloride.

The barium chromate does not need to be entirely removed from the flask, but of course the soluble potassium chromate must be completely washed out.

Remove the asbestos and adherent precipitate to a beaker. Mix 25 cc. of concentrated hydrochloric acid with 75 cc. of cold water. Wash out the crucible with some of this acid, thus dissolving any barium chromate left in it, and bring the solution into the beaker with the asbestos. Then pour the contents of the beaker, asbestos and all, into the Erlenmeyer flask containing the residue of barium chromate, add the rest of the acid and dilute to about 200 cc. As already pointed out it is essential for accuracy that the acid should not be much if at all above room temperature and that there should be enough of it.

Take the reading of the burette containing sodium throsulphate solution and add to the solution of chromate, about a gramme of potassium iodide and immediately titrate with the throsulphate, running in at about the rate of two or three drops a second, until the brown color due to the iodine has nearly disappeared. Then add starch paste and shake the liquid vigorously. Add throsulphate a few drops at a time, shaking the flask vigorously after each addition, until the blue color has nearly disappeared. Add 10 cc. of concentrated hydrochloric acid and warm to about 40°C. and add throsulphate a drop at a time, until the blue color gives place to the pale green of the very dilute chromic chloride. This method of titration after addition of potassium iodide was that followed by my students who had had experience with a similar titration of lead chromate, where more than a gramme of potassium iodide should not be used, or the precipitate of lead iodide formed would give trouble. In this case the throsulphate should be added at once lest iodine escape. On the other hand the titration must be slow, as the reaction between acidified chromate and potassium iodide is somewhat sluggish. Since barium iodide is soluble, it is possible in the case of barium chromate to add enough iodide to insure the retention of the iodine in the solution, so I think that five or six grammes of potassium iodide might be added and the titration postponed for ten minutes when the throsulphate could be run in rapidly until the iodine had almost disappeared.

If there is any considerable amount of strontinum in the barite a double precipitation of the barium chromate is necessary and can be carried out as follows:

Dissolve the precipitate in the Gooch with the smallest quantity of 1 : 1 nitric acid, alternating a few drops of acid with a stream of hot water. Thus one or two cubic centimeters of acid is enough. The acid must be completely washed out, but it is not essential that the last trace of barium chromate should be dissolved as the strontium content is small. Bring the solution into the Erlenmeyer and treat as in the first precipitation. It is probably not necessary to add quite so much potassium chromate as before, but considerable excess is required to make complete precipitation immediate. Filter through the same Gooch crucible as before, the asbestos mat in which has not been disturbed. The further procedure is precisely the same as already described

A throsulphate solution of approximately 18 grms, per litre, $Na_2S_2O_3$, $5H_2O$ is suitable; and the titration can be made against 50 cc. of a solution of three grammes per litre of barium chloride $BaCl_2$, $2H_2O$. With this solution of throsulphate, 0.25 grams of barium sulphate would not require more than 50 cc.

The time required, starting from the stage of barium chloride is about an hour; and if a double precipitation is necessary, twenty or twenty-five minutes longer. This is evidently quicker than igniting and weighing the chromate

Experiments were made with barium sulphate taken from a bottle in the store room. After the absorbed moisture, which amounted to a little over one per cent., had been driven off, the residue was according to the analyses of several students, pure barium sulphate. They used the ordinary determination of changing the barium to carbonate and back again to sulphate.

Two students determined the barium oxide by weighing the chromate in a Gooch crucible heated inside another larger crucible. They obtained BaO, 65.33% and 65.36%, respectively, (theoretical, 65.70%). These results were low, but the precipitate doubtless contained a little sulphate, because the ammonium dichromate used for its precipitation contained a little sulphate, as I discovered later when seeking the cause of some unsatisfactory results reported to me.

Another student standardized the throsulphate against barium chloride finding that 50 cc. of barium chloride solution required 26.07 cc. of throsulphate. His determination of barium sulphate gave 65.58% BaO; that of another man using the same standard gave 65.60%. The number, 26.07 cc. was judged correct, as another titration which was thought to be overshot by a drop or two gave 26.18 cc.

A mixture of barite and celestite containing some calcite was analyzed without ignition. Three students who made a double precipitation of the barium chromate, obtained, respectively, 26.85%, 26.98% and 27.05% BaO.

Another who precipitated only once obtained a result 28.60%, doubtless having some strontium with the barium; the mixture analyzed containing nearly equal amounts of each.

According to the results obtained in our laboratory, the volumetric method described for the determination of barium can be highly recommended for speed and accuracy.

Personal

Mr. J. W. Ruggles has been elected second vice-president of the Standard Chemical Iron and Lumber Company, Toronto.

Mr. C. V. Corless, manager of the Mond Nickel Company, on Saturday, April 6th, addressed the Royal Canadian Institute in Toronto on "Educational Reform."

Mr. R. A. Whitman, one of Canada's foremost geologists, is leaving Northern Ontario to open an office at 43 Exchange Place, New York.

Edgar M. McDougall, president of the Canada Iron Foundries, Limited, died on April 4th in Los Angeles, Cal. Deceased was a native of Montreal, and a graduate of the R.M.C., Kingston.

Mr. W. R. Leadbeater, M.A., formerly chief chemist at the Dominion Sugar Company's works at Wallaceburg, Ont., has taken the position of chief chemist at the mills of the Wayagamack Pulp and Paper Company at Three Rivers, Que.

Messrs. A. A. Cole, Wm. McInnis, D. B. Dowling, A. W. G. Wilson, Herman Donkin, T. C. Dennis, W. G. Miller, J. S. DeLury, J. T. Stirling and W. Fleet Robertson, have been appointed an Advisory Board to assist the Canadian Munition Resources Commission in a survey of mineral resources.

Mr. W. J. Dick has resigned his position as mining engineer of the Commission of Conservation at Ottawa, to become fuel engineer for Coal Sellers, Limited, Winnipeg, and consulting engineer for several western collieries. Mr. Dick, who is one of the leading fuel experts in Canada, was the winner of the Dawson Fellowship in Mining at McGill.

F. R. Campbell, chemist for the Spanish River Pulp & Paper Mills at Sturgeon Falls, has left to take a position with the West Virginia Pulp & Paper Company, at Tyronne, Pa., where the United States Government is to put in a plant for the recovery of spruce turpentine from the sulphite process.—Pulp and Paper Magazine.

Mr. J. L. McNicol has resigned his position as vice-president and managing director of the Wax and Glassine Paper Company, of Cookshire, Que., and has been appointed as advisory assistant to Mr. R. A. Pringle, K.C., Paper Commissioner. Mr. McNicol has held a number of important positions in connection with Canadian pulp and paper mills, and was on the staff of the Canadian Forest Products Laboratories in Montreal. He has invented a number of improvements in paper mill equipment, one of the most important of which is the paper weight regulator.

Books Received

We have to acknowledge the receipt of the following books, review of which will appear in the next and succeeding issues:

"Albert, 4th Earl Grey," by Harold Begbie. Publishers, Hodder & Stoughton, Limited. Price, 75 cents.

"Chemistry of Rubber," by B. D. Porritt. Publishers, Gurney & Jackson, London. Price, 2/- net.

"Fixation of Atmospheric Nitrogen," by Joseph Knox. Publishers, Gurney & Jackson, London. Price, 2/- net.

"Chemists' Pocket Manual," by Richard K. Meade, M.S. The Chemical Publishing Co., Easton, Pa.

"Inorganic Chemistry," by Horace G. Byers. Charles Scribner's Sons, New York.

"A Laboratory Manual of General Chemistry," by Horace G. Byers. Charles Scribner's Sons, New York.

"The Quebec Streams Commission, 1916"—Fifth Report. Quebec Government.

"The Industries of British Columbia." The Progress Publishing Co., Limited, Vancouver, B.C.

Recent Incorporations.

Edmonton.—Unilectric Company of Canada, Limited. Geo. Bligh O'Connor, barrister. Capital, $20,000. To carry on a wholesale and retail electrical business.

Hamilton.—Tallman Brass & Metal, Limited. Jos. N., Wm. N. and Addison H. Tallman. Capital, $800,000. To manufacture and deal in all kinds of metal products and do business as miners, smelters and engineers.

Montreal.—Harbison-Walker Refractories Company of Canada, Limited. Louis A. David, K.C. Capital, $10,000. To purchase and develop mines and lands containing coal, clay, ores, metals and minerals.

Montreal.—John J. Deery Company, Limited. John W. Blair, K.C., Francis J. Laverty, K.C. Capital, $40,000. To manufacture and deal in all kinds of building stone.

Vaudreuil Station.—The Agricultural Cement, Tile & Drainage Company, Limited. Walter Seely Johnson, barrister, Montreal. Capital, $25,000. To manufacture and deal in all kinds of cement and clay products.

Winnipeg.—Gordon, Ironside & Fares Packers, Limited. Leopold Macaulay and Wm. T. Sinclair, solicitors. Capital, $3,000,000. To operate abattoirs and to manufacture and deal in fertilizers, soap, liniments, etc.

Toronto.—Hercules Rubber Company, Limited. J. A. Campbell, J. L. Ross, J. H. Greenberg. Capital, $150,000.

Toronto.—Aetna Gold Mines, Limited. S. S. Mills, E. G. Goodwin, P. Home. Capital, $1,000,000.

Vancouver.—Trifolium Oleomargarine, Limited. Capital $100,000.

Deseronto.—The Quinte Chemical Company, Limited. Capital, $40,000. To manufacture chemicals, oils, drugs, etc.

Victoria.—"Canadian Steel Corporation, Limited." Head office, Ojibway, Ont. Provincial head office, 918 Government Street, Victoria. H. G. Lawson, barrister, Victoria, attorney for company. Capital, $20,000,000.

Toronto.—International De Lavaud Manufacturing Corporation, Limited. Carroll D. Dyke, real estate agent. Capital, $6,000,000. To manufacture and deal in foundry implements and apparatus of all kinds, and to carry on the business of general contractors and engineers.

Montreal.—Lee Coal Company, Limited. Ernest G. Vipond, K.C. Capital, $25,000. To mine and deal in coal, coke, copper, and other minerals and metals.

Winnipeg.—Dominion Metal Exporters Company, Limited. Edward G. Barrett and Leonard R. Barrett, manufacturers. Capital, $500,000. To deal in all kinds of scrap metal.

Joliette, Que.—La Compagnie à Bois Bédard, Lte. Dr. Joseph P. Laporte. Capital, $250,000. To own and operate lumber, pulp and paper mills.

Toronto.—Canadian Fluorite, Limited. Wm. R. Wadsworth, solicitor. Capital, $500,000. To acquire and develop mines and treat ores, metals and minerals.

Sudbury.—Smith & Travers Co., Limited. Geo. J. Valin, solicitor. Capital, $500,000. To do exploration and development work in oil, gas, metals and minerals, and carry on business as geologists and engineers.

American Synthetic Indigo

The National Aniline & Chemical Company, represented in Canada by Canadian Anilines and Chemicals, Limited, Toronto, are building a synthetic indigo plant at Marcus Hook, Pa., to be in operation in a few months. The work is under the direction of Dr. E. S. Johnson, of the Semet-Solvay Company, and Mr. Robert M. Strong, chief works engineer of the Marcus Hook plant. When the European War broke out and the supply of indigo was threatened the General Chemical Company, the Barrett Manufacturing Company, and the Semet-Solvay Company, recognizing the chemical catastrophe represented by the lack of indigo, entered upon its co-operative development. Research men from each organization were delegated to experiment and about eighteen months were consumed before, in the matter of quality and yields, the product of the great German plants had been equalled.

On this basis the new plant is founded, and it is expected the supply will soon be sufficient for United States requirements.

British Dyes, Limited, whose works are at Huddersfield, England, have succeeded in producing many new dye compounds of high quality. They are also manufacturing nitric acid, fuming sulphuric acid and intermediates, such as benzidine, betanaphtol and synthetic phenol, as well as fine dyes. Soon after the company took over the works of Read, Holliday & Sons, Limited, the authorities of the Huddersfield Technical College projected a scheme for building and equipping new premises for a coal-tar color department. Recently a special committee, including representatives of British Dyes, Limited, of J. W. Leitch & Company, and the Deputy Mayor, has been formed and much is being done to improve the equipment of the chemistry department in the college, and to give new impetus to the research work being carried on. Two types of men employed are the works chemist who is allowed to work in the laboratory at whatever time convenient and the graduate who is sent by his firm for full time training in research work.

In the case of the three men killed in the explosion of a tank in the Hamilton Tar and Ammonia Works last month the jury found that the explosion was due to overpressure and the company was held to be to blame for not having pressure gauges on the tank.

Douglas A. Mutch, manager of the Hudson Bay Mine, Cobalt, has been appointed manager of the Dome Lake Mine, Porcupine.

Mr. W. E. Loomis, of Sherbrooke, Que., has been elected to the board of directors of the International Portland Cement Company. Mr. Loomis is a brother of General Loomis.

Mr. H. S. Van Scoyoc, chief engineer of the Toronto-Hamilton Highway Commission, has been appointed manager of the publicity department of the Canada Cement Company, with headquarters at Montreal.

Mr. Leslie R. Thomson, C.E., at present on the staff of the Dominion Bridge Company, has been appointed secretary of the Advisory Council for Scientific and Industrial Research.

Chemical and Metal Markets

The Quotations below represent average prices for the quantities indicated. Larger quantities may be obtained at lower figures.

TORONTO, May 8th, 1918.

If the chemical and metal markets are more settled and quiet than during the past three or four months this quietude is more due to the difficulties of transport and the tightening grip of government control of commodities than to any lack of enterprise among manufacturers and merchants.

In the new United States Government's regulation restricting imports and exports Canada and Mexico have been exempted in the case of quite a number of commodities owing to geographical and industrial relationship.

In the dyestuff industry there has been a brisk demand for colors for khaki cloth and blues and prices are firmer. The supplies of blanc fixe and barytes are light and higher prices are asked. Linseed oil is scarce, and the expected supplies from Argentina have been held up for want of tonnage. A considerably increased acreage in flax is being planted in Ontario and the North West for the double purposes of seed for oil, and fibre for the making of airplane wings, since the usual supplies from Russia are cut off. Meantime the crop in the Northwestern States is reported nearly 25% below the acreage of last year. As to petroleum new fields are being developed in the United States, and efforts are being made to increase production in Canada.

Tin crystals are practically off the market just now.

The commandeering of metals for war trade is hampering many industries in Canada and the United States. The output of the Canadian Steel producers is increasing, but not to correspond with the demand, and it is almost impossible to obtain for commercial industry rods above 2 inches owing to the quantity turned into shells. Prices are therefore firm while nominally the same as last month. Tin has gone up still further and is now sold at $1.20 per pound, though nominally at the $1.00 level. In the United States market new supplies are practically unobtinable.

Prices for aluminium have been established by the United States Government as follows:

For 50 tons and over of 99% plus aluminium, 32.20c.; for granulated, 32.40c. per pound. For 98-99% metal, 32c.; for the granulated metal, 32.20c. For 94-98% aluminium, 31.20c.; for the granulated, 31.40c. For No. 12 metal, 32.20c. per pound. For 15 tons the price of 99% aluminium is 32.20c., the granulated 32.50c., while one-ton lots may be sold for 32.40c. and 32.60c. for the granulated of this quality. The 98-99% aluminium in 15-ton lots is 32.10c.; one ton, 32.20c.; the granulated, 32.30c. for 15 tons and 32.40c. for one ton. Metal, 94-98% in 15-ton lots is 31.30c., and one-ton lots, 31.40c.; the granulated of this grade being 31.50c. for 15-ton lots and 31.60c. for one-ton lots. No. 12, in 15-ton lots is 32.30c. and for one ton, 32.40c. These are cash prices at the plants for ingots. The base price for sheets was fixed at 40c.

Acetanilid, C.P.	Lb.	1 10—1.20
Acetic acid, commercial, crude, 28%, in bbls.	Lb.	.9½—.9⅜
" " 80 per cent. pure	Lb.	.29—.33
Acetone	Lb.	.50— 55
Alcohol. grain, bbl	Gal.	8.50
Alcohol, methylated, .bbl	Gal.	1.60
Alcohol, wood, 95 per cent., refined	Gal.	1.55
Alum, ammonia lump	100 Lbs.	$6.00—6.50
Aluminum Sulphate, high grade, bags	100 Lbs.	3.50—4.00
Ammonia, Aqua .880	Lb.	.18
Ammonium Carbonate	Lb.	.14
Aspirin (acetyl salicylic acid)	Lb.	4.00
Benzoic Acid	Lb.	6.00—7.00
Bleaching Powder, 35% drums	100 Lbs.	3.50
Borax, crystals	Lb.	.10—.10¼
Boric Acid, powdered	Lb.	.17
Calcium Chloride, fused, in drums	Lb.	.2½
Carbolic Acid, white crystals	Lb.	.90—.100
Carbon Bisulphide	Lb.	.10—.15
Caustic Soda, ground, Bbl	Lb.	.07—.08
China Clay, imported	per ton	$25—$30
Chloroform, com	Lb.	.75—.90
Citric Acid, domestic, crystals	Lb	.90—1.00
Cobalt Oxide, black	Lb.	1.50—1.75
Copper Sulphate (Blue Vitriol)	Lb.	.11—.12¼
Fuller's Earth, powdered	100 Lbs.	6.00
Glycerine, 56 lb. tin	Lb.	.80
Hydrochloric Acid, carboys, 18°	Lb.	.03¼—.03½
Lead Acetate, white crystals	Lb.	.20
Lead Nitrate	Lb.	.18—.20
Magnesium Carbonate, B.P., bbl	Lb.	.17—.18
Nitric Acid, 36° carboys	100 Lbs.	9¼—9¾
Oxalic Acid	Lb.	.55
Phosphoric Acid, S.G. 1750	Lb.	.75
Potassium Bichromate	Lb.	.70—.75
Potassium Bromide	Lb.	2.00—2.25
Potassium Carbonate 90 to 95%	Lb.	.85—95
Potassium Chlorate, crystals, Kegs	Lb.	.50—.60
Potassium Nitrate......, Kegs		(Nominal)
Potassium Permanganate, bulk	Lb.	4.00
Salicylic Acid	Lb.	1.25—1.50
Silver Nitrate	Oz.	.90—.95
Soda Ash, bags	Lb.	.03½--.04
Sodium Acetate	Lb.	.20—.22
Sodium Bicarbonate, 100% pure	100 Lbs.	3.75—4.00
Sodium Bichromate, bbls,	Lb.	.24—.25
Sodium Cyanide, bulk, 98-99 per cent, in cases	Lb.	$ .45
Sodium Hyposulphite, kegs	100 Lbs.	3.60—4.00
Sodium Nitrate, refined	100 Lbs.	8.50—9.00
Sodium Silicate, according to density	100 Lbs.	4.00—5.00
Sulphur, ground	100 Lbs.	3.00—3.50
Sulphur, roll	100 Lbs.	4.50—5.00
Sulphuric Acid, 66°Be, carboys	100 Lbs.	3.25—3.75
Tannic Acid, commercial		(Nominal)
Tartaric Acid, crystals or powdered	Lb.	.58—.90
Tin Chloride, crystals		(Nominal)
Zinc Sulphate, com	Lb.	.6½—7.00

Metals

Aluminum, No. 1, 98-99% ....base price	Lb.	.50—.60
Antimony	Lb.	.18—.19
Arsenic, white	Lb.	.15—.17
Brass, yellow ingots	Lb.	.18—.20
" red	Lb.	.25
Cobalt, metal	Lb.	2.25
Copper, casting	Lb.	.29
Copper, electrolytic	Lb.	.30
" Am. Government price (electrolytic and casting	Lb.	.23½
Iron, bars	100 Lbs	5.25
Lead	Lb.	.09
Magnesium	Lb.	2.50
Mercury	Lb.	2.00—2.50
Nickel, electrolytic	Lb.	.50—.55
Platinum, pure	Oz.	105.00
Silver, bar	Oz.	.92—.93
Spelter	Lb.	.09
Steel, mild	100 Lbs	5.50
" nickel, in bars, 3½% Nickel	Lb.	.25—.26
" sheet, Bessemer, 28 gauge	100 Lbs.	8.00—9 00
Tin	Lb.	1.20

Business Items

The United States Varnish Co. of New York have appointed Dawson & Hopkins, McKinnon Building, Toronto, as their Canadian Sales Agents.

Messrs. H. Reeve Angel & Company, distributors for Whatman Filter Papers, have moved their offices and stock rooms from 120 Liberty Street to 9 Spruce Street, New York. At their new address they have larger quarters and better marketing facilities.

The difficulty of procuring platinum and the great cost of that metal, so much more precious than gold, makes the question of a substitute very interesting. In another part of this issue the Palo Company, of New York, announce a rhotanium alloy as a reliable substitute and offer proof of its success.

Mr. W. E. Foster now represents the Pfaudler Company in New York City with headquarters at 110 West 40th Street. Mr. Philip S. Barnes, formerly with the Avery Chemical Company, of Lowell, Mass., is now associated with the Pfaudler Company's sales department as consulting chemical engineer, with headquarters at the New York office. Mr. J. A. Cowles, for many years connected with the executive offices in Rochester, is now also established at the New York office, where his knowledge of manufacturing processes is being turned to good account. The company's Chicago office has been removed from the Schiller Building, to 1442 Conway Building. Mr. R. B. Kilmer is in charge. Mr. H. L. Wagner, formerly with the Jensen Creamery Machinery Company of New York, is now on the staff of the Chicago office. Mr. Wagner has had a valuable experience in connection with equipment for handling milk and milk products, and expects to turn it to good account in presenting Pfaudler glass enameled steel equipment to the dairy trade.

Industrial News

The Maritime Art Glass Works, Limited, is likely to be removed from St. John to Halifax, N.S.

The new bleaching plant of the Port Arthur Pulp and Paper Company, at Port Arthur, is now turning out bleached and unbleached sulphite. They are employing about two hundred and fifty men and have enough wood on hand to last a year.

Investigations for the development of a commercial process for producing a high-grade domestic fuel from sawdust, are to be carried out at McGill University by the Council for Scientific and Industrial Research.

Mr. D. H. Ross, Canadian trade commissioner at Melbourne, thinks there is a good market in Australia for drugs and chemicals, of which imports there amount to over $15,000,000. The present difficulty is that many of the items wanted in Australia are such as the Canadian market is also short of.

McArthur Irwin, Limited, dealers in chemicals, Montreal, are increasing their output of dry colors which they have been manufacturing for some time. One of their specialties is Paris Green. Additions are now being made to their premises in order to enlarge the output. This company owns the only works in Canada for the production of extract of hemlock.

The demand for castor oil as a lubricant for airplanes has stimulated quite an interest in the growing of the castor bean in the United States. A warm climate is required to bring the bean to maturity, and it is proposed to start castor oil cultivation under Government auspices in Texas, California and Florida.

The lignite briquetting plant arranged for between the Dominion and Provincial Governments of Manitoba and Saskatchewan will be established at Estevan, and is to be in operation by next winter. The federal government puts up $200,000 and the provincial governments, $100,000 each.

The Hon. Mr. Ballantyne, Minister of Marine, has made an agreement with the Dominion Steel Coporation for the erection, in connection with their steel plant at Sydney, N.S., of a mill for the rolling of ship plates. This is a new and important feature in the industrial life of Canada.

The Kipawa Fibre Company, Limited, has recently been formed for the purpose of manufacturing a high grade of bleached sulphite pulp. The new company is managed jointly with the Riordon Pulp & Paper Company, Limited, and their mills will be erected at Temiskaming, Que., thirty-eight miles from Mattawa.

The firm of William H. Scheel, 159 Maiden Lane, New York, is now putting on the market several new products among which is "Scheel-lac," a substitute for orange and bleached shellac. It is said by a varnish maker to be "the nearest thing to shellac ever produced," and will dissolve in alcohol as easily as shellac. The firm is now developing a new wax to replace carnauba wax, and this is being tested before being placed on the market.

Some New York capitalists are about to establish a steel plant in British Columbia, a lease having been signed for a tract of the Indian Reserve near New Westminster, for twenty-one years, renewable for twenty-one years more. The capacity is to be one hundred tons a day, the output at first being fifty tons. Electric furnaces are to be used.

The Canada Copper Company, which succeeded to the holdings of the British Columbia Copper Company, has let a contract to the Kettle Valley Railroad for the construction of fourteen miles of railway line linking up the company's property at Copper Mountain and Princeton. The Canada Copper Company has also successfully floated a bond issue of $2,500,000, with which it is building a 3,000 ton mill. The output of the Canada Copper Company will be dealt with by the smelter and refineries at Trail.

Scheelite has been found in the Falcon Lake district, Manitoba, near the molybdenite deposits discovered last fall. This tungsten ore was found by a prospector who had attended the evening classes for prospectors at the University of Manitoba. The ore was brought to the instructor, Mr. J. S. DeLury, by Mr. J. MacMillan and was identified as scheelite. It is noteworthy that the molybdenite disocvery last fall was also made by a prospector who attended the evening classes at the University.'—Can. Mining Journal.

The Hellenic Chemical & Color Company, Inc., is negotiating for a new factory in Brooklyn, four times the size of the one it is now occupying. This makes the seventh enlargement of these works. The company manufactures and deals in lakes and dry colors, aniline dyes and textile specialties and on some of its lines has orders for several months ahead. A great portion of their output is taken up by the United States Government and other large users of their products. The company controls the output of three factories—one in New York; one in Brooklyn, and one in Philadelphia.

CLASSIFIED INDEX OF ADVERTISEMENTS

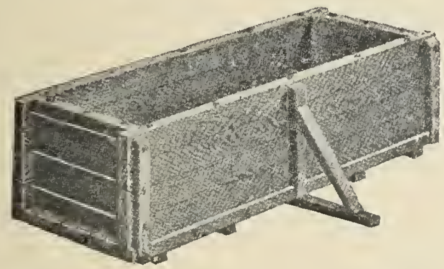
"ACME" SPRAYING PRODUCTS

ARSENATE OF LIME — BORDEAUX MIXTURE
LIME SULPHUR SOLUTION — NICOTINE SULPHATE

ACME NICOTINE KEROSINE SULPHUR SOAPS

ACME LABORATORIES, Limited
263-265 YONGE ST. and 132-134 RICHMOND ST. W. TORONTO

WOOD TANKS



Any Size — For All Purposes
Goold Shapley & Muir Co. Limited, Brantford, Canada

DAYLIGHT SAVING

Clean white walls will throw daylight or artificial light into the dark corners of your factory, warehouse or office. This means greater production and more workable space.

PAINT WITH

Crown Diamond Factory and Mill White

Made in Flat or Gloss Finish

It is Durable, Washable and Very White

WRITE FOR ESTIMATE

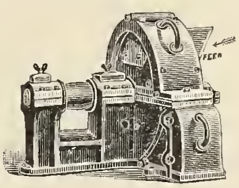
McARTHUR, IRWIN, LIMITED
MONTREAL ESTABLISHED 1842 TORONTO

U. S. Acid Proof Paint

SEND FOR SAMPLE ON TIN--READY TO TEST

Absolutely proof against the strongest acids and alkalis—even proof against chlorine—air dries in 30 minutes—will stand 350° Fahr. Contains no oil, asphalt, coal tar or pigment.

U. S. VARNISH Co. 41 Park Row, N.Y.
DAWSON & HOPKINS
Canadian Sales Agents, McKinnon Bldg., Toronto



DISINTEGRATORS

ALL TYPES OF
GRINDING, SIFTING, DRYING and SEPARATING MACHINES

J. HARRISON CARTER LTD.
DUNSTABLE and LONDON, 12 Mark Lane
ENGLAND

Use for Your Products

The Up-to-Date Package Which Will Not Leak

Send for Your Copy of No. 13

Smart-Turner STEEL BARREL Catalogue

THE SMART-TURNER MACHINE CO., Limited, - Hamilton, Canada

ANILINE DYES

MANUFACTURED BY
THE SCHOELLKOPF WORKS, BUFFALO, N.Y.

Basic, Acid, Direct, Union and Chrome Colors

Special Attention Given to the Matching of Shades

CANADIAN ANILINES & CHEMICALS LIMITED
14 FRONT STREET EAST - - - - TORONTO, ONT.

Index of Advertisements

EMPLOYMENT DEPARTMENT

The charge for condensed advertisements of "Engagements Wanted," or "Positions Open," is 50 cents per month for advertisements of 40 words or less, no charge being made for the use of box numbers in care of CANADIAN CHEMICAL JOURNAL.

ENGAGEMENTS WANTED

Young man, graduating from University of Alberta, desires position as chemist. Organic work preferred. Not liable to be drafted. Address: N. M. Stover, 11117 88th Avenue, Edmonton S., Alberta.

Chemist, B.Sc., Canadian, 27, desires change. Research experience in metallurgy and organic chemistry. Experience in metallography, micro-photography, organic analysis, testing of lubricants; liquid, gaseous and solid fuels; analysis of ores and non-fereous alloys. Salary must be attractive. Apply Box 12, CANADIAN CHEMICAL JOURNAL.

CHEMIST, familiar with gun-cotton, powder, TNT, nitric and sulphuric acids. Experienced in analysis of acids. Capable manager. Box 5, CANADIAN CHEMICAL JOURNAL.

POSITION wanted by an analytical chemist, University Graduate in Chemistry. One year's experience in large laboratory. First-class references. Apply Box 2, CANADIAN CHEMICAL JOURNAL.

Experienced chemist desires responsible position. B. Sc. of a British University, F.I.C., and a graduate of a well known technical college ; several years experience in organic research. For over five years have held present position as Chief Chemist to large firm. First-class references. Address Box 4, Canadian Chemical Journal.

A young engineering student desires a position in a chemical laboratory. Complete high school education as well as two years at Toronto University in the department of chemical engineering.—Box 16, CANADIAN CHEMICAL JOURNAL.

POSITIONS OPEN

Industrial concern located three hours from large city, wants immediately a young graduate chemist (man or woman) for analytical work. Must have good experience in routine analysis. Application forwarded to Box 14, THE CANADIAN CHEMICAL JOURNAL. State salary wanted.

CHEMICAL ENGINEERS WANTED

A large corporation about to develop a electro-chemical process on a large scale requires the services of a technically trained engineer of broad experience, preferably one familiar with the manufacture of soda ash by the ammonia-soda process.

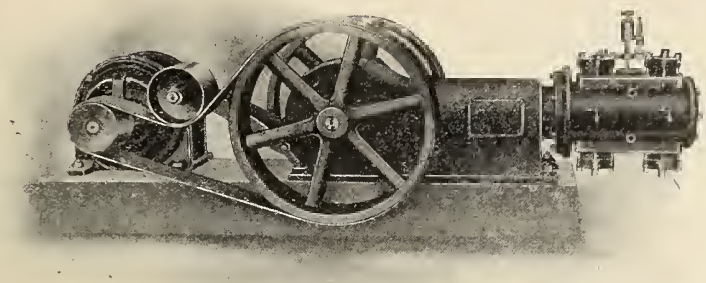
Also

Chemical Engineer, familiar with the design and operation of electric furnaces.

Submit detailed record of training and experience and state salary desired. Send copy only of references. All negotiations will be treated confidentially.

Address Box 20, CANADIAN CHEMICAL JOURNAL.

Compressed Air in the Chemical Plant



Power-driven, single-stage straight-line air or gas compressor.

For agitating, spraying, scaling, caulking and testing, compressed air is indispensable. The Air Lift Well system is simple and economical, and for transferring acids and other liquids the Pneumatic Displacement method has the additional advantage that heavy fluids and semi-fluids may be pumped from tank to tank without any valves or restricted passages to clog.

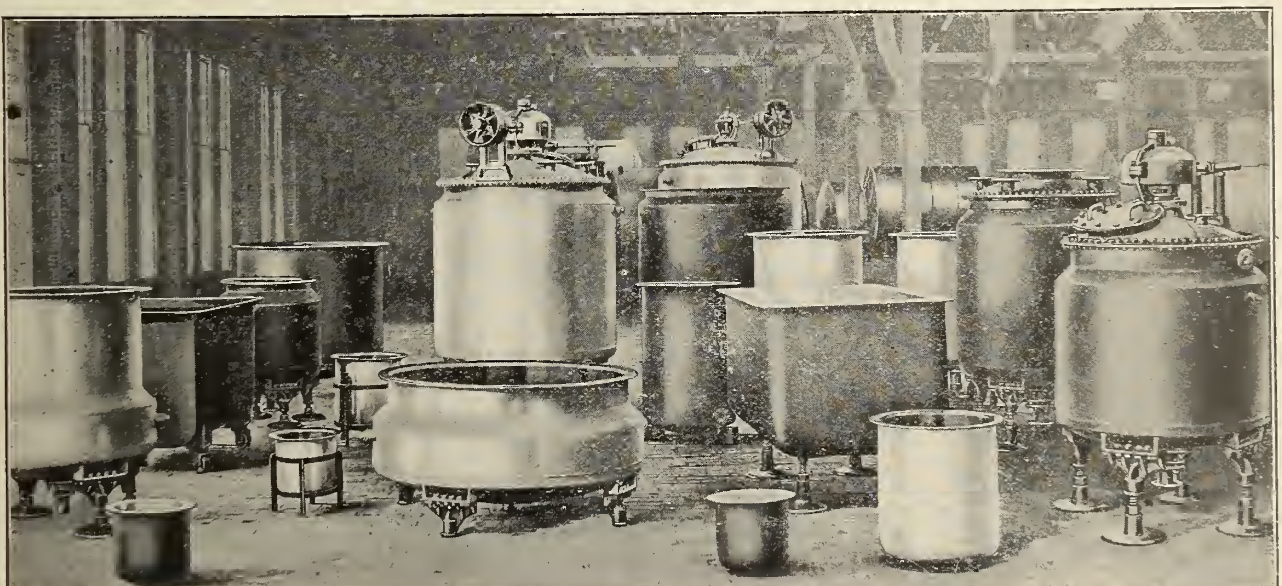
For all such services as the above you need an efficient, compact Air Compressor. With the Imperial Short-belt drive a 10x8 (180 cu. ft.) motor-driven compressor can be tucked away, motor and all, into a space 11′x0″x2′x6″.

Investigate—it will pay—you will learn of real economies you can effect in your plant by using Compressed Air.
Our Engineering and Sales Departments are always at your service.

CANADIAN INGERSOLL-RAND CO., LIMITED

General Offices: MONTREAL, CANADA

Branches at: SYDNEY SHERBROOKE MONTREAL TORONTO COBALT TIMMINS WINNIPEG NELSON VANCOUVER



PFAUDLER Glass Enameled Steel Equipment

Into these substantial steel Mixing Tanks, Kettles and other large vessels, enamels of unusual density and resistivity are fused with exceptional thoroughness. This permits the nearest possible approach to the duplication of laboratory conditions of immaculate cleanliness in your plant.

SEND FOR BULLETIN C-4

THE PFAUDLER CO., ROCHESTER, N.Y.

Acid-Proof Chemical Stoneware Apparatus

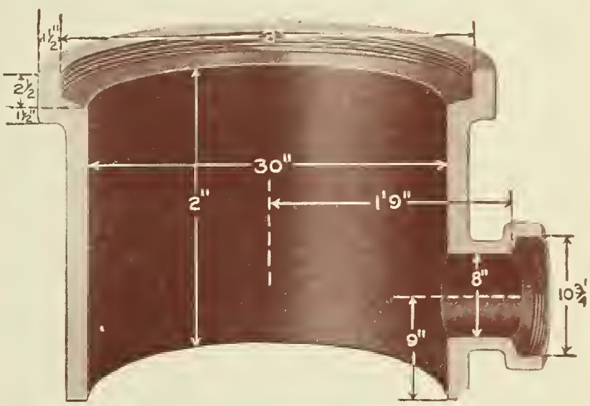
STANDARD or SPECIAL

All guaranteed Acid-Proof Throughout ; Vitrified yet Tough.

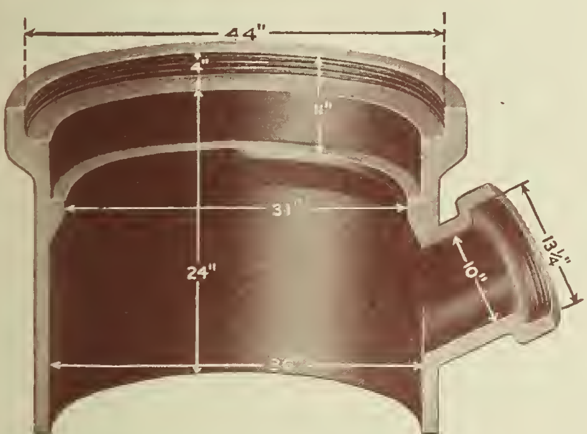
Made in America by Americans who know how.

IT IS THE BODY ITSELF

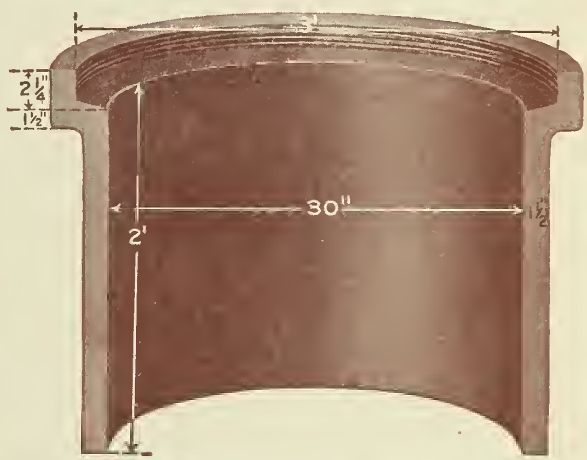
ACID-PROOF TOWER DISTRIBUTOR
Made to fit any size or bore tower from 12" to 42'



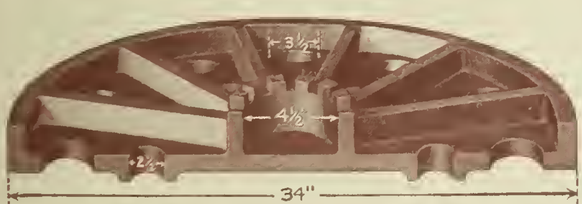
ACID-PROOF TOWER TOP SECTION
Or can be used as inlet bottom section by using cascade



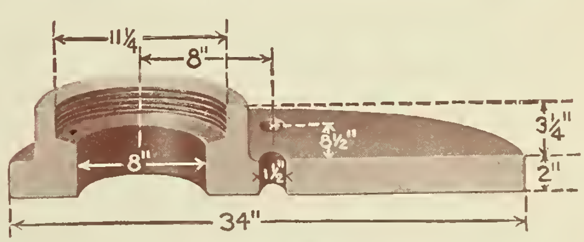
ACID-PROOF TOWER BOTTOM SECTION
Showing 10" Y and Ring for supporting perforated plate, or as top section for distributing plate.



ACID-PROOF PLAIN TOWER SECTION
Notice heavy grooved sockets. We make tower pipe in any bore from 12" up to 42"



ACID-PROOF DISTRIBUTING PLATE
Made in many sizes and designs.



ACID-PROOF TOWER COVER
Used with internal distributing plate and doing away with Y or Tee outlet top section.

We carry a large stock of Acid-Proof Brick and other tower packing.

MAURICE A. KNIGHT — Office and Factory Kelley Avenue — **East Akron, Ohio**

CANADIAN CHEMICAL JOURNAL

A Canadian Journal devoted to Metallurgy
Electro-Chemistry and Industrial Chemistry.

Vol. II, No. 6 | TORONTO, JUNE, 1918 | 20c. a copy; $2 a year

PROFESSIONAL DIRECTORY

CANADIAN
CHEMICAL JOURNAL
A Canadian Journal devoted to Metallurgy
Electro-Chemistry and Industrial Chemistry.

Vol. 2 TORONTO, JUNE, 1918 No. 6

CANADIAN CHEMICAL JOURNAL

DEVOTED TO THE CHEMICAL AND METALLURGICAL INTERESTS OF CANADA.

Published monthly by the Biggar Press Limited

Office, 36 Toronto St., Toronto, Canada

Telephone Main 7399. E. B. BIGGAR, Managing Director

Subscription price, $2.00 per year to Canada, United States and all parts of the British Empire.

Time of going to press, 1st of each month. News and changes of advertisements should be in hand one week before.

NOTICE

The Editorial Department exercises every care to ensure the correctness of the contents of the Journal. It is understood that the authors of signed articles are alone responsible for the statements they may make, whether of fact or opinion. Address all editorial correspondence to 36 Toronto Street.

Principal Contents

Back numbers of the Canadian Chemical Journal are wanted, dating from July to December inclusive. Full price will be paid for copies received with reading matter pages in good condition.

Owing to the amount of space taken by the Convention Report a number of articles have been crowded out of this issue.

To complete sets of the current volume, the publishers will be glad of back numbers from January to April inclusive, and will pay full price for undamaged copies, or will credit the amount on the sender's subscription.

The Convention

THE general convention of Canadian chemists held at Ottawa last month was better than the most optimistic had expected, both in point of attendance and keen interest in the proceedings. Few looked for an attendance exceeding fifty, but over a hundred registered while many were present whose names were not on the register. Of those listening to the discussions quite two-thirds were young men, which is a very hopeful sign.

As our report indicates, the presence of the chemists was recognized in Parliament and in the press. Sir George E. Foster, with an instinct for anticipating economic changes that is not possessed by every statesman, addressed to the convention a letter which opened the door to a more direct co-operation than hitherto existed between the industry and the people's government. This step is important in its timeliness and in the augury it conveys of stability and permanence to the rapidly developing chemical, electro-chemical and metallurgical industries of Canada, which, under the changing conditions of the country, now dovetail into practically every industry from A to Z—from Agriculture to Zinc smelting.

In a historical sense the Ottawa convention has already become a landmark in the history of applied chemistry in Canada. There will no longer be action, more or less unco-ordinated, by the scattered units of local Sections, but by an organization of national scope, and serving and conserving the chemical and allied industries of every province. The happy relations with the parent society in Great Britain will no doubt continue in intimacy, at the same time new bonds of fraternity will naturally develop with the American societies and the recently formed French Société de Chimie Industrielle.

It may not be long before every province has its local Section, or Society, but whatever form the advance takes, the stimulus of the first convention will remain with us, and it is now the duty of every chemist to step into the movement whose progress, like that of the printer's art, tends to advance all other interests by the development of its own.

Platinum

THE present extraordinary demand for this metal has called marked attention to the sources of supply.

Report of the Dominions Royal Commission states that 95% of the world's production came from the Ural Mountains in Russia, but unfortunately, this source is being rapidly exhausted, as in 1911, the output there shows 300,000 Troy ounces, and in 1916, it had fallen to 78,674 Troy ounces.

The many directions in which platinum only can be used to advantage, and the narrowing output has led to an extraordinary advance in prices; figures ranging from $110 to $125 per ounce, and as the demand for metal is increasing, it would appear that the forward movement in its value will continue for some time.

Definite figures, for the last year in which they were obtainable was 1916, when the world's output was as follows:

Russia	76,674 ounces.
Republic of Columbia	25,000 "
United States	750 "
New South Wales and Tasmania	222 "
Canada	60 "

The Republic of Columbia appears to be the only country where there is any marked improvement in the increased production.

We learn with satisfaction that the Canadian Government has decided to send an expert to investigate the possibilities of increasing the platinum yields in the Tulameen and Similkameen Valleys in British Columbia. The Tulameen has been well represented in the output of platinum in the past, and the entire district shows evidence of platinum bearing rocks as well as large quantities of platinum in the gravel and sands of the river-beds. So far, only sporadic individual efforts have been made in the district in question with varying results, and it is to be hoped that the movement of the Federal Government in instituting a complete investigation will show very satisfactory results as to the increased yield of platinum in Canada. The Tulameen and Similkameen are not only promising as a source of platinum, but the sands and gravel yield show good percentages of osmium, iridium and gold. Gold was worked very thoroughly in the district many years ago, but at that time the platinum was not considered of sufficient value to attract the miners' attention, and consequently was in most cases thrown away by them when found with the gold. Kegs of it were cast aside as useless and these collections have since been covered with debris.

The investigating party is under the control of Mr. Charles Camsell, of the Mines Branch, Department of Mines, Ottawa, Ont.

Since the above was in type we have received a report from the Bureau of Mines, Washington, stating that the War Industries Board has ordered the commandeering of seventy-five per cent of the platinum in the hands of manufacturing jewellers; while refiners and dealers will be required to yield their stocks of platinum to the government. It is added that these measures will only fill a small part of the gap in the national requirements. Hence the Dominion Government, in taking up the development of the British Columbia deposits referred to, is acting wisely in the interests of the allied nations, for no private mining company could devote the amount of labor and capital required to make an immediate and thorough test of the B.C. deposits.

THE Honorary Advisory Council for Scientific and Industrial Research is beginning to make its work tell upon the industrial developments of the country. The chemical committee of the council, under the chairmanship of Dr. R. F. Ruttan, held a meeting at Ottawa on the 20th May at which several important subjects were considered, such as industrial alcohol, the application of chemistry in utilizing various waste materials, as for example straw, waste from pulp and paper mills, etc. Recommendations on these and other subjects will be made in due course.

RECOMMENDATIONS have been made informally by the Society of Chemical Industry through Dr. Ruttan, and by the Royal Society of Canada, in a resolution proposed by Prof. W. Lash Miller, of the University of Toronto, in favor of a Canadian National Bureau of Research, to include a bureau of standards. A suggestion on these lines also appeared recently in THE CANADIAN CHEMICAL JOURNAL. We understand that the Government has decided to carry out the idea, the plan of which will nearly parallel that of the Bureau of Standards at Washington which has rendered incalculable service in the scientific and industrial progress of the United States.

IT IS greatly to be regretted that the late session of Parliament was allowed to end without provision for an immediate start on the hydro-electric production of nitrogen from the air, recognizing as all intelligent public men should do, that nitrogen and its compounds are as vital to the industries of peace as they now are for the successful prosecution of the war. The United States Government now has four plants for the fixation of atmospheric nitrogen in contemplation, involving an expenditure of $150,000,000, or three times the amount originally intended. In reply to Senator Nicholls, the leader of the Senate stated that investigations were being made into this subject, but "no arrangements have so far been made for the manufacture of atmospheric

nitrogen in Canada." Seeing that the first step in such plant is a power development which requires time for construction, one would have thought that this first step would have been taken so that the provision of power would be completed and ready by the time the investigators have reported on the best process. This would avoid the loss of precious time.

Dean Goodwin

The election of Dr. William Lawton Goodwin, Dean of the Faculty of Applied Science in Queen's University, as Chairman of the Society of Chemical Industry, is a fitting tribute to a man who for many years has been foremost in advancing both the academic and the industrial phases of his chosen work.

Dr. Goodwin was born in Baie Verte, N.B., sixty-two years ago. His roots are deep in New Brunswick history, for a Goodwin was among the two thousand sturdy New Englanders who sailed under General Monckton to capture Beausejour in 1755, and later settled in the newly-won colony. He received his early training at Mount Allison Academy and University. At twenty-one he was awarded the Gilchrist scholarship, which has given so many eminent Canadians their first big opportunity. The years of his scholarship term were spent in the study of chemistry, mainly at the University of Edinburgh, where he received the degree of B.Sc., followed by study in London and Heidelburg. After two years as a demonstrator in chemistry at the University of Edinburgh, and the University College, Bristol, where he worked with Sir William Ramsay, and a year as professor in Mount Allison, Dr. Goodwin was appointed, in 1883, Professor of Chemistry at Queen's University.

Dr. Goodwin's work, in the thirty-five years which have passed so rapidly since then, has been of a varied kind. Foremost he would doubtlessly himself place his activities as a teacher, for it has been in the daily work of the laboratory and the classroom that his heart has been, and it is by his lucid and stimulating teaching that successive generations of his "boys," as he likes to call them—and of late years, his "girls"—will always remember him.

Perhaps more distinctive was his work in organizing and building up the School of Mining at Kingston, of which he was director from its founding in 1893 to its formal inclusion as the Faculty of Applied Science of Queen's in 1916. It was a day of small things, and it needed all the indefatigable enthusiasm and hard work of Grant and Goodwin to build up the equipment and staff and student body to adequate proportions. While all branches of engineering were gradually developed, mining remained for many years the dominant interest. It is with much satisfaction that Dr. Goodwin and his colleagues, among whom Dr. W. G. Miller was prominent for the first ten years, look back on the work done by the graduates, and by the men who took the short-term Prospectors' Courses, in the development of mining in Ontario, as well as in other parts of Canada and in the United States. Another phase of the work of the School, in which the Director was particularly interested, was its extension courses, and particularly the classes offered in various centres in New Ontario in the early days. With the establishment of other branches of engineering on a firm basis, Dr. Goodwin of late years has been able to give his efforts particularly to the expansion of the course in Chemical Engineering. A strong staff has been built up, and in the well-equipped laboratories of the new chemistry building, Gordon Hall, several important research investigations are under way. Throughout his career he has emphasized the necessity of close connection with the industrial requirements of the country.

In a busy life, Dr. Goodwin has found time for many outside interests, from music and bird study to fishing and curling, which have kept him constantly the youngest member on his staff, and the chosen companion of the children of all his friends. His kindly and genial nature have done as much as his broad scholarship and untiring devotion to his work to give him a wide circle of friends, who will hope that for many years he may be able to give his energy and enthusiasm to the advancement of the chemical industry of Canada.

Merging of Departments

The Inland Revenue Department at Ottawa is to be amalgamated with the Department of Customs. It is understood that the branches of chemical analysis, inspection of food and weights and measures, will in consequence be placed under the Department of Trade and Commerce, to which department will also be transferred the work of trade marks and patents for many years carried on under the Department of Agriculture.

Montreal Letter

By J. C. Ross

Montreal, Que., June 10th, 1918.

There has been some improvement in the heavy chemical situation, although the business is handicapped through transportation difficulties, the licensing restrictions and the outright embargoes. The two chief sufferers among the industries are the tanners and the textile operators, but even their troubles are becoming adjusted to a considerable extent. Some of the largest importers are negotiating through Ottawa with the United States and British Governments and hope to have some of the present restrictions removed, or else lightened to a considerable extent.

Prices of all lines of heavy chemicals, as well as drugs, dyestuffs, etc., are tending in an upward direction, with the exception of one or two commodities, which have remained stationary. The business in heavy chemicals is brisker and better than it was a month ago, but the general manufacturing demand is somewhat quieter.

A new and important industry is about to be started in Quebec province. A company, organized by Hon. S. M. Parent formerly Premier of this province, and various other capitalists, has for its purpose the establishment of a ferro-silicon plant. The new plant is to be located at St. Anne de Beaupre, celebrated as the seat of the shrine of Ste. Anne, on the St. Lawrence about twenty miles below Quebec. Some 16,000 square feet of land has been purchased and a plant is now being erected, together with a branch railway line, some nine miles long. In addition to that, the company has purchased a large tract of land, known to contain low grade iron ore. When Mr.

Parent was Premier of Quebec a dozen or more years ago, his attention was attracted to the immense titaniferous iron ore deposits in the province, but it is only now that he was able to interest sufficient capital to make possible the working out of schemes he has had under consideration during these years. In the meantime, however, experiments made by American and Swiss engineers with the low grade ore in this province, did much to encourage Mr. Parent. According to his plans, they will treat and utilize the low grade ore, the titanic acid contained in the ore and the other by-products. Those connected with the undertaking are very optimistic about its future.

An interesting talk on the initiation, progress and development of coal gas was given by Mr. F. J. Kennedy before the Chemical Club at McGill University a short time ago. In the course of his address Mr. Kennedy traced the history of artificial light, going back to the time of the Romans, and touched on the various changes made, until coal gas was discovered in Scotland in 1797. Mr. Kennedy showed that the City of Montreal was the first place in the British Colonies to use coal gas, the first being used here in 1840. At the same time, he pointed out that the gas works in this city were the fourth in size in the British Empire. Although electricity came into use in this city in 1888, the figures show that from that time to the present the use of gas had increased by over 70%, thus indicating that there was room in the field for both methods of lighting. In connection with the shortage of fuel, Mr. Kennedy stated that the National Fuel Administrator of the United States had advised people to use gas so as to save coal. The use of gas meant the securing of many valuable by-products.

The closing meeting of the Montreal Electrical Association was held a few days ago, when Professor N. N. Evans, of McGill University, gave a talk on Chemical Research, which proved to be one of the most interesting of the season.

Montreal is being accused by "dope" fiends of being the centre of the trade in Canada. Recently some men arrested in Toronto said that the city of Montreal was the headquarters in Canada for the securing and distribution of dope. This city's large foreign population and also the fact that it is a seaport, makes the detection of dope fiends a rather difficult task. A few days ago a man accused of smuggling drugs into Canada was arrested in Boston, and he also gave his home as Montreal.

In its issue of May 30th the Pulp and Paper Magazine stirs up the pulp and paper mill chemists to a greater interest in the Society of Chemical Industry. The editor makes these comments on the convention:

"The Society of Arts, the Society of Chemical Industry and other chemical societies met in joint session at Ottawa last week. It was intended to be a gathering of chemists representative of the chemical industry of Canada. There were one hundred and ten in attendance, about twice the number anticipated. Not one chemist from a pulp or paper mill was there. While the pulp and paper industry does not employ so great a proportion of chemists in relation to the number of employees as manufacturers of drugs, chemicals, explosives, etc., it is for the most part a distinctly chemical industry. The Society of Chemical Industry is the British Society of Chemists, and it should have the support of the pulp and paper industry. There are now three sections in the Canadian branch—at Toronto, Ottawa, and Montreal. It is planned to have local associate memberships, so that a man need not necessarily be a full member of the society to enjoy the fellowship of the chemists in his locality and benefit from their association. By more frequent attendance of manufacturers and others interested in chemical industries and products at meetings of the society, the meetings and discussions would be better and both chemistry and industry would benefit. If any readers of this magazine are interested, they should address the General Secretary, Mr. A. Burton, Explosives Department, Imperial Munitions Board, Ottawa. The pulp and paper industry is so fundamentally a chemical one that our mills and chemists can easily see the advantage of associating with and supporting the Society of Chemical Industry."

American Institute of Chemical Engineers

The Summer Meeting of the American Institute of Chemical Engineers will be held at Gorham and Berlin, N.H., June 19 to June 22.

A good program of papers has been prepared, and the following plants of the Brown Company will be visited under the leadership of Mr. Hugh K. Moore ; Sulphite Mill, the largest of its kind in the world ; Saw Mill and Photographic Department, The Cascade Paper Mill, Chemical Plants, including Electrolytic and Caustic Plants; Fiber Tube Mill, Carbon Tetrachloride Plant, Chloroform Plant and Hydrogenated Oil Plant.

A joint meeting with the local section of the American Chemical Society will be held on the first evening at the Mt. Madison House, Gorham, the Convention headquarters. A unique feature of the program will be an entertainment by the employees of the Brown Company.

Recent Incorporations

Hamilton, Ont.—Zimmerman Manufacturing Company, Limited. E. H. Ambrose, H. A. Burbidge, J. R. Marshall, A. B. Turner, barristers. Capital, $1,000,000. To manufacture and deal in linen, cotton and other fabrics; also bleaching and dyeing materials.

Sudbury, Ont.—Petroleum and Gas Products, Limited. Geo. J. Valin, solicitor. Capital, $1,000,000. To acquire lands containing petroleum, salt, chemicals, metals or minerals of any kind, and to develop and deal in the same.

Welland, Ont.—Dillon Crucible Alloys, Limited. L. B. Spencer and L. C. Raymond, solicitors. Capital, $100,000. To manufacture steel and iron of every description, including crucible, alloy, and tool steel.

Westmount, Que.—Standard Electric and Acetylene Welding Company, Limited. Richard T. Heneker, K.C., Henry N. Chauvin, K.C. Capital, $10,000. To carry on business as iron and brass founders and to manufacture and deal in metals from the ore to the finished product.

Winnipeg, Man.—Bowman-Thayer United, Limited. John Hamilton Parkhill, manager. Capital, $50,000. To locate, develop and deal in coal, clay, brick, earth and other metal and mineral susbstances, and to manufacture and sell patent fuel.

Calgary, Alta.—Branham Dredging Company, Limited. Wm. Wadleigh (Edmonton). Capital, $500,000. To carry on operations as a mining and reduction company, and to deal in metals, minerals and chemicals, and products thereof.

Sarnia, Ont.—Holmes Foundry Company, Limited. Anthony I. McKinley, solicitor. Capital, $500,000. To manufacture and deal in steel, iron, brass and aluminium products of all descriptions, and to operate smelters, refineries, leacheries and chemical works.

Quebec, Que.—Canadian Ferro Alloys, Limited. L. Macfarlane, Gordon W. MacDougall, Wm. B. Scott. Capital, $250,000.

Catalogues Received

Catalogues have been received from the Detroit Heating and Lighting Company, manufacturers of gas machines, heaters, stills and electric apparatus, Detroit, Mich.; from the Pfaudler Company, manufacturers of glass enamel steel equipment for the chemical industries, Rochester, N.Y.; from Darling Bros., engineers, Montreal; and from the Hydraulic Machinery Company, Montreal.

Notices of these and other catalogues will appear in a later number.

Group photograph, Convention of Canadian Chemists from the Balcony of the Chateau Laurier

Convention of Canadian Chemists

The first general convention of the chemists of Canada was held at the Chateau Laurier, Ottawa, on the 21st and 22nd May, under the presidency of Mr. Theo. H. Wardleworth, chairman of the Canadian Section of the Society of Chemical Industry.

The following is a list of those registered:

From Beloeil Station—P. V. Rosewarne, Canadian Explosives, Limited.

From Buckingham, Que.—Fred J. Hambly, Electric Reduction Company, Limited.

From Carleton Place—G. S. Howard, M.D.

From Deloro—W. L. Rigg, Deloro Smelting and Refining Company.

From Edmonton—Prof. Lehmann, University of Alberta.

From Fredericton, N.B.—A. Cameron, University of New Brunswick.

From Guelph—Prof. R. Harcourt, Ontario Agricultural College; Dr. W. L. Kaufman, Malt Products Company of Canada.

From Halifax—Prof. E. V. MacKay, Dalhousie University.

From Kingston—Dr. John Waddell, Dr. W. L. Goodwin, J. A. McRae, Prof. L. F. Goodwin, all of Queen's University.

From Kitchener—J. E. Breithaupt, Breithaupt Leather Company.

From Lindsay—Dr. Alfred E. MacIntyre, Lindsay Arsenal.

From Macdonald College—Prof. J. F. Snell.

From Montreal—F. M. Mooney, McArthur, Irwin Limited; Prof. N. N. Evans, Dr. R. F. Ruttan, Dr. F. W. G. Johnson, F. W. Skirrow, T. Maass, V. K. Kreeble, G. S. Whitby, all of McGill University; Dr. John S. Bates, Forest Products Laboratory; A. J. Banks, Ogilvie Flour Mills; Theo. H. Wardleworth, Imp. Munitions Board; Harold J. Roast, James Robertson Company, Limited; A. G. Fleming, Canada Cement Company; I. Grageroff, J. B. Bell, Canadian Explosives; E. E. Wells, John Cowan Company, Limited; Arthur F. Robertson, National Drug & Chemical Company; R. M. McLean, Dr. J. T. Donald, J. T. Donald & Company; Fraser S. Keith, Engineering Institute of Canada; W. A. Allen, Watson, Jack & Company; J. N. Stephenson, Pulp and Paper Magazine.

From New Glasgow—J. Miller, Imp. Ministry of Munitions.

From Niagara Falls—Geo. H. Tomlinson, Kinzinger, Bruce & Company.

From Ottawa—S. J. Cook, L. E. Westman, F. C. Collier, R. M. Rowatt, O. G. Lye, A. Valin, A. Lemoine, L. Erle Johnson, V. Kitto, R. H. Tapley, Dr. A. McGill, S. Mirskey, Miss S. Elizabeth Wright, all of Inland Revenue Department; Edgar Stansfield, M. F. Connor, Eugene Haanel, K. A. Clark, J. Moran, H. C. Mabee, F. A. Baridon, J. H. Nicolls, R. E. Gilmore, all of Department of Mines; Dr. Frank T. Shutt, C. Robinson, Experimental Farm; H. P. Bell, Census and Statistics Office; E. Viens, Public Works; A. E. MacRae, Patent Office; Joseph Race, Civic Laboratories; F. W. Babington, Dr. Alfred Tingle, Customs Laboratories; J. R. Donald, A. N. Macaulay, D. S. Cole, G. M. Ponton, N. W. Pirrie, all of Imperial Munitions Board; E. A. Smith, Irrigation Branch; O. J. D. Thomas, Max Haff, Col. D. Carnegie.

From Saskatoon—Prof. R. D. MacLaurin, University of Saskatchewan.

From Shawinigan Falls—A. F. C. Cadenhead, G. E. Grattan, M. J. Marshall, Canadian Electro Products.

From St. Hyacinthe, Que.—A. T. Charron.

From St. John, N.B.—A. F. Blake, Atlantic Sugar Refining Company.

From Toronto—Prof. E. G. R. Ardagh, Prof. M. C. Boswell, Dr. W. H. Ellis, Prof. F. B. Allan, Prof. W. Lash Miller, all of the University of Toronto; M. L. Davies, Standard Chemical Company; J. H. Mason; T. Linsey Crossley, J. T. Donald & Company; Alfred Burton, Honorary Secretary, Society of Chemical Industry; F. C. Noice, Peerless Rubber Company; W. A. Lawrance, Toronto Carpet Manufacturing Company; J. Douglas Stone, Campbell Flour Mills; A. J. MacDougall, A. T. Stuart, Toronto Power Company; E. B. Biggar, CANADIAN CHEMICAL JOURNAL; H. E. Rothwell, Harris Abattoir Company; A. R. Bonham, Provincial Board of Health.

From Trenton—Granville B. Frost, Imperial Ministry of Munitions.

From Vancouver—Prof. C. Berkeley, Dr. D. McIntosh, University of British Columbia.

From Washington—Dr. J. Watson Bain, Canadian War Mission.

From Winnipeg—Prof. H. S. Davis, Mrs. H. S. Davis, Prof. Matthew A. Parker, University of Manitoba; F. J. Birchard, Department of Trade & Commerce; E. L. C. Forster, Inland Revenue.

The first day was chiefly taken up with visits to the government laboratories, including the fuel testing plant; to the Royal Mint, and to the works of the E. B. Eddy Company at Hull. The government laboratories having been recently described in this JOURNAL it need only be stated here that the visitors were impressed with the special features shown. An American authority said of the laboratories of the Mines department that they were equal to the best in the United States. A large party went in the afternoon to the paper and pulp mills and the match factory and wood-fibre ware department of the E. B. Eddy Company, where they were piloted by Mr. Thomas, the company's chief chemist. The match department of this company has a capacity of from seventy to seventy-five million

matches per day. It was stated that the new duty on matches has the effect of more than doubling the cost of a box of matches to the consumer.

Visit to the Royal Mint

The visit to the Mint proved very instructive to all the visitors. The fact that some of the rooms containing bar gold were kept securely locked during the visit was not taken to be a reflection on the chemists, but only that the officials were faithfully observing a rigid rule of the Mint. One of these rooms had at the time, gold bars amounting to $2,250,000, and the least affluent of the chemists could go away saying that they had had over two millions "in sight" if not in hand.

In the last number of THE CANADIAN CHEMICAL JOURNAL an account was given of the new chlorine process of refining gold prepared by Mr. Ralph Pearson, the chief assayer.

To this may be added the following explanation by Mr. A. L. Entwistle, of the general process of treating metal at the Mint:

"The rough gold received from the mines is melted, in quantities of about 3,500 ounces, in large graphite crucibles in premelting furnaces. The molten metal is then ladled into clay pots which are placed in graphite guard pots in the chlorination furnaces. A covering of borax glass is placed on top of the molten metal and chlorine gas passed through the whole by means of clay pipe stems connected by rubber tubing to the lead pipes leading to the chlorine gas cylinders, each of which holds one hundred pounds, the flow of gas being regulated by a metal valve. The base metals, namely copper, zinc, lead, etc., are volatilized as chlorides, the silver is converted into silver chloride which remains in the pot. When all the base metal and silver have been converted into chlorides the process is complete, the finishing point being ascertained by the characteristic brown stain shown on a pipe clay rod inserted in the top of the chlorine pot above the molten mass. If the chlorination is carried too far, there is a risk of losing gold which would volatilize as gold chloride. The silver chloride is now ladled off into moulds. A little bone ash is sprinkled on the surface of the gold and any adhering borax or silver chloride forms a pasty mass which is cleaned off by a graphite flat stirrer leaving a clean surface of gold. The refined gold is then poured into moulds holding about 600 oz. The chlorine pot being replaced in the furnace is ready for another supply of rough gold. The fine gold ingots are melted in tilting furnaces in melts of about 12,000 ounces and poured into flat bars 8½"×4"×1¾" which weigh approximately 550 ounces each. Three small sample bars for assay are taken during the process of pouring, and represent the 22 bars obtained from one pour, the average assay being 995.0.

"The silver chloride, which contains a small portion of gold, obtained from the chlorination, is melted in large graphite crucibles and then 10% of carbonate of soda added gradually in two charges. This reduces a portion of the silver, which, falling down through the molten chloride, carries with it all the gold contents. The crucible, when all action has ceased, is drawn from the furnace and allowed to cool until the metal in the bottom has solidified; the silver chloride, which is still liquid on account of its low melting point, is poured in flat moulds 12"×12"×2". These cakes are subsequently washed free from copper chloride, etc., in wooden tanks with boiling water, then reduced to metallic silver with iron plates, washed, dried and melted into 1,000 ounce bars for coinage. This silver is gold free and assays 999.0 to 999.5.

Most of the metal remaining in the bottom of the graphite crucible, containing approximately 25 to 30% gold and the remainder silver, eventually goes through the chlorine process again. The other portion of this metal is treated in the silver cells by the electrolytic process (an adaptation of Moebius' process). This results in silver of 999.5 fineness being deposited on the cathodes and a black residue left containing approximately 94% gold. This black residue goes through the chlorine process. Any rough deposits suspected of containing platinum are chlorinated to a fineness of about 980.0 to 990.0, melted, poured into anodes and refined in the gold cells by Wohlwill's electrolytic process. The refined gold obtained assays 999.0 or over; any platinum in the rough deposits is left in the electrolyte and eventually recovered as platinum black."

The plant here has for a considerable period turned out an average of a million ounces of fine gold per month. International transactions are now so large that practically no gold is being turned into coin, but is reckoned in bars of 550 oz. each.

The processes through which the metal passes in being converted from the ingot into the finished coin were outlined as follows by Mr. A. H. W. Cleave, M.I.M.E., Superintendent of Coining:

"The ingot is received in the Melting House and placed, with the necessary alloy, in the melting furnace. When molten, it is poured into moulds, thus forming bars. These bars are removed from the moulds as soon as they have cooled sufficiently and taken to the shearing machine and revolving files, where the spongy ends are removed and the edges trimmed. From the first and last bars of each pot assay pieces are cut by the assay cutter and sent to the assay department, where the standard fineness of the pot is ascertained. If the assay report is unsatisfactory, the necessary amount of fine precious metal or alloy, is added (as the case may be), and the pot is re-melted. If the assay report is satisfactory, the bars are delivered to the Rolling Department. They are passed several times through the breaking down mill, then several times through the thinning mill, and finally through the finishing mill, after which the strips should be approximately of the correct thickness.

"The variation from standard that is allowed in the weight of gold coins is so slight that rolling alone is not sufficiently accurate; therefore each fillet, after leaving the finishing mill, has one end flattened, for about 3 inches, in the flatting mill, and is then passed to the draw-bench where it is drawn between two fixed hard steel cylinders. This operation ensures the fillet being of uniform thickness throughout its length. The flattened ends are then removed by the shearing machine, and the fillets passed to the tryer. The tryer cuts one blank from each fillet, weighs it on a delicate balance and determines to which cutting-out machine the fillet shall be delivered.

"The cutting-out beds of the cutting-out machines are graded so that each machine cuts out blanks of different sizes. This arrangement ensures the greatest possible number of blanks being cut within the legal remedy for weight. The blanks are then passed to the marking machine where an edge is raised round each blank to protect the impression which will be subsequently given to them by the coining dies.

"The scissel (or skeleton fillet that is left after the blanks have been cut out) is made up into bundles and returned to the melting house for re-melting. The blanks are then passed through the blank annealing furnace; after which they are blanched in the acid tank and tumbling barrel, and washed in the hot and cold water tanks. They are then placed in a centrifugal drying machine, and revolved until dry. The blanks, softened and blanched, are then delivered to the coining presses, where the obverse and reverse impressions and the milling round the edge are made on the blanks.

"The coins are then sent to the weighing room and passed through the automatic weighing machines, where the light and heavy ones are rejected. Those of correct weight are then passed over the overlooking machine, where both sides are examined for discoloration or other defect. The good coins are then 'rung' on steel blocks to make sure that they have the correct ring and are not 'dumb.' The good coins are then delivered to the Mint Office for issue, and the defective ones defaced in the defacing machine and returned to the Melting House for re-melting."

The automatic weighing machine is a remarkable contrivance, for if a coin is light in weight by more than the hundredth part

of a grain it is dropped into a separate receiver, while if overweight to the extent of a hundredth of a grain it goes into a receiver on the other side. The "ringing" of the coins is done by hand, and the ear of the operator is so expert that over 60,000 coins are tested per day by each operator.

Evening Session

At the evening session a paper was read by Prof. M. C. Boswell, of the University of Toronto, on "Chemical Research in Agriculture." The author was congratulated on his paper, which brought out an interesting discussion. The paper and the discussion which followed will be dealt with in another number.

Wednesday, May 22nd

The first general business of the day was an address by Prof. M. A. Parker, of the University of Manitoba, Winnipeg, on "Organization of Canadian Chemists."

Prof. Parker said: "I congratulate the organizers and originators of this convention of chemists. I think this is a very interesting and important occasion. It is the first time the chemists of the Dominion have been convened together. It seems to me that this marks the beginning of a new era that will have an influence on every chemist in Canada.

"The enormous dimensions of this Dominion give us advantages and disadvantages. It is quite impossible for all the chemists of the Dominion to be present in one place at the same time. It is very important that there should be a common bond of interest among all in the profession of chemistry. We have all been struck by the extraordinary efforts which are being made towards organization in every walk of life, and it seems strange that chemists of certain of the older countries have not hitherto been more fully organized than they were a few years ago. It is only now that the chemists of Great Britain are making serious efforts towards complete organization. It is not to be wondered at, perhaps, that the chemists of Canada, who until within a comparatively recent time have not been in very great numbers, should not have had a Dominion-wide organization. But the time has certainly arrived when something should be done towards a fuller organization of our profession in Canada. It is true that the Society of Chemical Industry serves in a measure the purposes of organization, but unless the objects of this society were very greatly extended it would not fulfil the purpose completely.

"But there is another objection to the Society of Chemical Industry as the only organized body of chemists in the country, which is a point of discussion—that it does not restrict its membership to chemists. Others interested in chemistry are very welcome to become members of the Society of Chemical Industry, and they undoubtedly strengthen the Society very greatly, but they are hardly entitled to become members of such an organization as that which I, at any rate, have in mind. At the present time there is no society to which Canadian chemists feel it their duty to belong. There is no society to which chemists alone belong, and which none but qualified chemists are permitted to join. Yet some hesitate at the proposed formation of yet another chemical society, and indeed we all realize that the number of societies to which many of us have to belong is so numerous, so formidable a burden are the annual subscriptions, it would be folly to propose another society unless for some very important function, that could not possibly be filled by an existing society. What are the reasons which would permit one to form yet another chemical society or association?

"In the first place, there is the great importance of forming a bond of union among all the chemists throughout the Dominion. The reasons why such a bond should exist must, I think, be very obvious. But one most important reason will be found in the fact that were such a bond in existence, the profession of chemistry would be enabled at any time to throw the whole weight of its influence into any matters of professional and national importance. In the second place, we might consider the use and mis-use of the title 'chemist.' I think there should be some means of legally defining the term. Every one of us, I am sure, could cite examples of the mis-use of the term. Every one of us could name a number of friends who, when asked the meaning of 'chemist' would say it means one who dispenses drugs. This is no exaggeration. There is no doubt that men in the trade have that idea of a chemist. They think he is a man who dispenses drugs—in other words, a pharmaceutical chemist. Many pharmaceutical chemists are entitled to be called chemists. Many of them are admirable chemists, but the majority of them are hardly entitled to the use of the name.

"Then, again, there is another point which a new association might deal with. This is the registration of chemists, having secured a legal definition of the term. The new association might obtain power to act as the sole registration authority, for all chemists in the Dominion. This, I think, is a very obvious necessity. Why should it be necessary for a lawyer, a surveyor, or men of any other profession, to be registered as such, when it is not considered necessary for a chemist whose profession requires a very high degree of skill and training? Why should it be necessary for those others to be registered and yet not the chemists? In this connection it might also be advisable to safeguard the public by requiring that certain chemical operations be under the control of those who are registered as chemists.

"Finally, the new society would elevate the profession of chemistry to its proper position among the learned professions—a very important work. It seems to me that perhaps this can best be undertaken by such an association as I refer to. In this connection I should like, with your permission, to quote from the March number of The Canadian Chemical Journal, which, I dare say, most of you have seen, but I should like to refresh your memory by the very interesting letter and editorial in the same magazine, calling attention to the extraordinary disparity between the remuneration offered to chemists and that offered to lawyers in an advertisement issued by the Civil Service Commission. The advertisement for lawyers offered, you will remember, the initial salary of $3,300, the candidate to be twenty-eight years of age, to have a few years' experience in law, and he must possess a fair education—that was all. The chemist advertised for was to receive less than half that salary—$1,600, and this chemist, who was regarded as of less than half the value of this inexperienced lawyer, was to have a thorough training in chemistry and physics, and must hold a degree from a recognized university. He must prove his ability to 'take out' (strange phrase) original research work, and to have subsequent experience as a practical chemist; great accuracy required, etc., etc. The disparity of these two salaries will be readily understood by anyone who has received a chemical training. The editorial in the same issue of the Journal calls attention to the fact that it would take the chemist seventeen years to reach the salary at which the lawyer with only a few years' practical experience in law begins. It is evident surely that the profession of chemistry must receive such support as will raise it to a more honorable position among the learned professions. That must be desired by all of us, not, I think, from merely a personal standpoint, but for the national welfare as well. There must be some means taken to encourage the very best men in the country to enter the profession of chemistry, and that will not be secured until more generous recognition is given to the requirements and training needed for the production of good chemists.

"Can these objects be accomplished? Perhaps they can, but I don't think they can be accomplished by any existing organization. It might be possible by the formation of a new association or institute to secure some results, and the matter ought, I think, to receive the fullest possible discussion, and with the object of introducing it I am prepared to bring forward one or two resolutions.

"The matter was first brought to my notice by the report of the proposed formation of the British Association of Chemists, which, as most of you know, is tentatively formed and is at present negotiating with the Institute of Great Britain and Ireland. In drawing up these resolutions I have made free use of the resolutions proposed at their meetings, because I do not think I could put the matter before you in any better form than there given. But I have purposely avoided the use of the term 'Institute of Chemists,' because I think it would be somewhat misleading. These resolutions are drawn up in order to bring the matter up before you for full discussion."

"As regards the title 'chemist,' I am not aware whether the status in Canada is like that in Great Britain where a pharmaceutical chemist is legally entitled to call himself a 'chemist.' The true chemist is not debarred, but the pharmaceutical chemist is also legally entitled to use the term. It seems obvious that if we were to form such an association we could not at the outset be very strict as to the admission of members. We should have to begin in a somewhat generous way, and include persons who, perhaps, later, would not be regarded as eligible for membership. I am not wedded to the wording of these resolutions. You may modify them as you please, but I would like to have the very fullest discussion, and it is with this object that I have brought these resolutions before you."

Dr. Parker then read two resolutions setting forth that it was desirable to form an association of chemists in Canada and that a committee be appointed to consider the matter and report to the present convention.

Discussion of Dr. Parker's Resolutions

Dr. R. F. Ruttan: I hope Dr. Parker's resolutions will receive full discussion. I think we are now at the parting of the ways. In Canada chemists form a rope of sand as regards organization. Dentists, engineers, lawyers, doctors, are fully organized—chemists have no organization, and no representation in the legislative halls of Canada. For this reason I am fully in accord with the idea of forming a Canadian association or Canadian institute of chemistry which will have no relation to any other American or Canadian chemical society except in general organization. It has been thoroughly shown by Dr. Parker that the main object is to create an organized body of those who have spent the whole or a large part of their lives in chemical work. The definition of a "chemist" is an extremely difficult thing. It has caused a great deal of trouble in England. I hope we shall not split on this question. We shall be extremely liberal, as Dr. Parker says. Later we can put the screws on, and make the association more exclusive. Another object we should keep before us is that such an association as this would tend to permit of co-operative action in the economic interests of chemists. Their salary, their reumuneration, their position as thoroughly trained scientific men, as compared with doctors, lawyers, engineers, are such that action must be taken by chemists as a body if we wish to obtain proper recognition. Still another object would be to obtain recognition of the proper status of chemistry in its relation to the national life of Canada. I would also emphasize the need of carrying on chemical research. These are the great objects to be attained.

I have much pleasure in seconding these resolutions as coming from such a representative gathering, and I expect a full discussion.

Chairman: I think it would be better for the meeting to take the resolutions "en bloc," because the points are so interrelated that it would be difficult to separate them. The subject will be looked at from all its different angles, so that we may have the opportunity to benefit from the most perfect discussion of this exceedingly important subject. The subject of titles became a problem in England in 1856, when anybody could put out his shingle and call himself a druggist. The government was requested to interfere for the protection of the public. This is one point which Dr. Parker would do well to consider—that the public interest is to be conserved by these restrictions. A bill was brought in by which those who were qualified as chemists only were allowed that title, and learners were allowed to pass a modified examination, and the evils complained of were remedied somewhat. Later an association known as the Pharmaceutical Association was formed and many used the term "pharmacist" instead of "chemist." At that time the Technical chemist was unknown, but the name "chemist" had already been appropriated by druggists and others.

Dr. Berkeley (Vancouver): May I draw your attention to a resolution passed at the general meeting of the Canadian Pacific Section in April last? It follows so closely the lines of this resolution that it would be unnecessary to bring it forward, but that I feel it my duty to have all members in harmony. Other technical organizations have taken similar action and the Canadian Pacific Section recommends definite action with the object of obtaining a charter. That resolution was adopted at the meeting held in Vancouver, April 22nd, and was prepared for the purpose of submission to this convention. It is as follows:

"Whereas, the chemists of Great Britain have proceeded towards the organization of a British Association of Chemists in order to obtain from the British Parliament a greater degree of protection for the members of their profession, and whereas it has been reported that other organizations of technologists, for example the Civil Engineers, have recently proposed taking similar action in Canada;

"Be it resolved, that we the members of the Canadian Pacific Section of the Society of Chemical Industry recommend that definite action be initiated at this first convention of Canadian chemists leading towards the organization of a Canadian Association of Chemists, which association shall apply to the Parliament of Canada for a charter and to obtain the necessary legislation for the better development of the profession of chemistry, and thus of our national life. J. A. Dawson, chairman; J. H. Hamilton, secretary."

Mr. Babington: Fifteen years ago the first question asked was what were one's qualifications in chemistry, in science, and in literature. But now in applying for a position, though one might have had a special training as an F.I.C. and other high qualifications, if one passed an examination as a Dominion public analyst, this was the only qualification taken notice of.

Mr. Griffiths (Montreal): The chemists, particularly the younger, think they were hardly treated. We have been two or three years discussing the matter. Now that we have an opportunity to do something, it is high time that everyone expresses an opinion. In presenting this matter before the government and the public we ought to take the broader view, to which our chairman has called attention, that in protecting ourselves by forming a close corporation we protect the public who depend upon our analyses.

Mr. Schorman: I'm going to speak from the point of view of the public's side of the matter. While I have been a resident in Toronto I have been interested in chemical analysis, and a number of young chemists there hang out a card as "analytical chemist." I have had quite a lot of work done by these men. Nine times out of ten it was a pitiful exhibition of chemistry. The science of chemistry has so wide a scope that it ought to be defined very clearly what particular thing a man is fitted to do. You cannot cover it all. In our business, which is oil refining, we are called upon to make a turpentine substitute, owing to the high price of turpentine. We made a substitute from crude petroleum, which answers the purpose as a paint solvent, etc., and which even smells like turpentine. We wanted it analyzed. We sent it to

the most complete laboratory in Canada. They examined it very thoroughly, and pronounced it 22% turpentine, although I am ready to swear it was a pure mineral product. Now I wish you would remember this—every chemist does not know it all. You are limited in your sphere of work. These limitations should be defined.

Dr. A. McGill: I am pleased with the explanations of Dr. Parker. The subject could not be presented more fairly or more definitely. It is due to the memory of a very old friend of mine, the late Dr. Girdwood, of Montreal, to recall the fact that the later years of his life were spent in more or less costly attempts to bring about what Dr. Parker's resolutions propose. A distinction must be clearly drawn between the objects kept in view by the two societies—the Society of Chemical Industry, and the society proposed to-day, which is something analagous to the Institute of Chemistry of Great Britain and Ireland. The aim of an institute of chemistry should be the interests of the workers as a body, but it must also protect the individual. As to the question asked by Dr. Tingle—"What do I get out of it?"—he gets a good deal out of it. He is entitled to be recognized not only by the public, but membership should be made a condition necessary to obtain a government appointment as chemist—the candidate should be a member of such a society and hold its diploma. I believe a public analyst in Great Britain must be a F.I.C. It would make it very much easier for our Civil Service Commissioners to describe the sort of man they want were some such qualification required here. As for the unqualified Toronto chemists, they may not have been so far out in their analysis of the crude oil especially if it had been treated otherwise than by distillation. The difficulty in the definition of a "chemist" is partly due to the fact that colleges and universities do not recognize any well defined and limited course for the degree of chemist, the standing of a graduate in this regard seems to be haphazard, branching off into mineralogy, histology, etc., as fancy may dictate.

Dr. Davis (Winnipeg): It is very pleasing to see the Society of Chemical Industry take the initiative in this matter. It will be important in the years to come, and I certainly hope that it will be possible to conserve the activities of this valuable society.

Dr. L. F. Goodwin (Kingston): Do we need this association? I think we do. The only point is how to secure it. I have been a member of the Institute of Chemistry of Great Britain for many years. I know something of their researches. As a student I objected strenuously to passing an examination to become a fellow of any institute. I simply did it because they wanted me to do so. What we propose now is to form a body which will have some public influence. This public influence which we need is a definite status for chemists as a corporate body. The Institute of Chemistry had an exceedingly high standard. They would not even admit undergraduates in chemistry from the universities. I was one of the few who were exempted from the undergraduate course, but I had to pass through all the classes. This institute was exclusively for those who belonged to it. A few years ago some modifications were introduced and it became a less exclusive body. It had been losing membership and influence. We must not make the same mistake. If we want to influence legislation, and we pick out from two hundred and sixty chemists some sixty, what voice are we going to have in the community? If we go to the Government with recommendations from only some sixty highly qualified F.I.C. men, what sort of a hearing are we going to get? No other body would be satisfied with that small number. We must have our club weighted. We should take an example from the American body swelling their number to ten thousand. We should not be so conservative. We should get more members like Dr. Tingle, of Ottawa. We should organize a campaign for increased membership. I think Dr. Parker's resolutions should be sent to a committee to be considered. We are to legislate for the next twenty or thirty years, and that can not be done here. Some years ago the American Chemical Society began to admit many more men of education and experience, and their membership rose to ten thousand. I would like to see practical chemists, men of influence, swell our ranks and increase our influence in the community. What we need more than anything else is an association of Canadian chemists. If, at some later period, ten or fifteen years, we will have so many members that a stricter examination will be desirable we can have it. But if we start now along the lines of the Institute of Chemistry of Great Britain it will be highly exclusive and antagonize many. I would move that a committee be appointed to go into the matter and report at a subsequent meeting.

Mr. Grageroff (Montreal): I agree with Dr. Goodwin that the committee should put the matter in permanent form. I will not speak further as to the advisability of such a society. There is the chemists' interest to consider as well as the public interest. It is a disgraceful state of affairs and something must be done for the chemical profession. How can a man be expected to devote all his life to serve the public as an enthusiastic chemist, keep up with the rest of his profession, read, study, without having a fair chance to get his mind off pressing household bills and raising his family? He cannot do it. It is an impossibility. The same state of things prevails in Great Britain as well as here, according to what I hear. Many chemists are paid less than expert pipe-fitters, who get 55 or 60 cents an hour. We should start a campaign. Let us educate the government and the people to rely upon the chemist's analysis, let them know that we are not like high school boys who rush through the work of three months in three weeks. (Laughter). Let us start one hundred per cent. pure. We should urge the government to take action. We can not do this if people are not quite sure that seventy-five per cent. do not know what they are talking about. We must point out to the public how many industries are dependent on chemists; let us point out the need of a highly intellectual standard; let us show that it is not the small analyst alone who is a chemist, that chemistry is a greater and more important work. If our expert chemists are limited in number to fifty or sixty they are taken on at a better salary, being masters of their profession.

Dr. Race (Ottawa): I will give a few figures in the first place. Canada has large numbers of chemists in addition to the three hundred members of the Society of Chemical Industry. We sent out over five hundred notices for this meeting. There is no reason, I think, why this organization should reduce itself to anything like the number suggested. Although I belong to the Institute of Chemistry I would not recommend any proceeding that did not meet local conditions. The Institute was developed to meet the needs of the country, and the development of local organizations to meet local needs did not necessarily follow the old organization. With regard to the resolutions I foresee one difficulty—the legal definition of "chemist"—the sole authority to register these being vested in the proposed body. What would be your legal definition of "chemist" when you must register all local chemists? You would have no alternative but to admit them. If the committee is appointed it should be done to-day, and meet to-day.

Dr. McGill: We have a strong, well-defined, and democratic tendency to manage by counting heads. We must remember that this association, like a chain, is only as strong as its weakest link. If this association is going to admit incompetent men its work will be discredited.

Mr. Lawrance (Toronto): As regards the society being too open, if the body is to be official it should not be too open. If it is too open then we will have an organization equivalent to the present Society of Chemical Industry. In my opinion it would be almost useless to form another society when the Society is already open. Personally my great objection to the present Society is that it has gone over the line. If the present Society,

or the proposed society, be limited, we will have something which will elevate its status not only, but also boost the salaries, which are, as you know, terribly small. I think the interests of chemistry in Canada would be greatly improved and bettered if the society were limited to those who are actually university graduates, or, at least, trained chemists.

Mr. E. Stansfield: The Canadian Society of Civil Engineers has agitated for recognition of the engineering profession in the Civil Service. Just recently one or two other professions had representatives on their committee to make some effort towards professional recognition. Unfortunately they were too late to have the Civil Service Act amended and thereby obtain recognition. Regarding the notorious advertisement for a chemist in the Civil Service previously referred to, I would explain that the phrase "take out" was a misprint. It was rather an unfortunate example to take up of "red tape," and "wheels within wheels." It is not as bad as it seems. Hundreds of other advertisements of the Civil Service might be cited. I think we are all agreed that we do need a great Canadian body of chemists. I agree very strongly with Dr. Goodwin. Dr. Parker's resolutions are excellent, but the resolutions from British Columbia are more practical. We now require to form a very strong committee, representing chemists from all over the Dominion to go into the matter thoroughly, consulting chemists of all chemical societies and all other chemists, the mining interests, etc. Their consultations would ultimately result in an Act of Parliament.

Mr. Cadenhead (Shawinigan Falls): As to strengthening the membership we must take into consideration what the American Chemical Society has done, not only for chemists, but for the good of the country at large. The big membership has had a tremendous effect in the United States. There at first there was no recognition of chemists, who were taken from industries vital to the war and put into the ranks. Through the efforts of the American Chemical Society these men were placed in positions such that their services in their profession, so valuable to the country, were adequately recognized. As to salaries, it seems to be true, I don't know why, that in some cases these are too low. I hope to see this remedied.

Dr. McKay (Halifax): The discussion has turned upon the question of the limit of membership. Since we are to have another society which represents a wider membership the co-operation of the two societies, the one limited in membership and the other with a large number of qualified chemists, might solve the difficulty.

Dr. Tingle (Ottawa): As regards the American Chemical Society and its large membership, this society is not to be compared at all with the body now proposed. It was free until about twenty years ago an attempt was made to limit its membership. Chemistry, in their definition, was recognized as a university subject or some such phrase. It is now just as open a society as the English society. Anyone can get into this latter if he is properly proposed. I am told that an editor at Aberdeen was made a fellow of the Chemical Society. He would be equally eligible to-day for membership in the American Society.

Dr. Goodwin: The exclusive American society was unable to carry any legislation in New York state, but the moment they increased the membership they were able to do so.

Mr. Thomas (Ottawa): What has the American Chemical Society accomplished for the individual chemist? Nothing, I say. Owing to its very largely advertised campaign for membership anybody can join. Another society more or less limited in membership would be a much better thing to uphold our status.

Mr. Roast (Montreal): Some suggest a university degree as the qualification for the proposed society; others, get all we can. Possibly there are some who are good chemists, who may not possess a college degree, but by subsequent work and fifteen years or more experience are recognized by the profession as chemists. There is no objection to such men becoming chemists. Perhaps we are on common ground. We don't want to exclude good men who may be without some specific degree, but we don't want incompetent men. As regards the committee (I am speaking for the younger chemists) let us not forget that the younger men should be represented by young men. We can get the view-point of the younger men if we have these latter on the committee.

The Chairman: Judging from the discussion we are beginning to tread on one another's heels. I shall treat the resolution as a recommendation, and I shall put the amendment proposed by Dr. Goodwin as a substantive motion, and request the committee to take advantage of all this and make recommendations upon definite lines, as the matter has been thoroughly canvassed. Your trouble will be in arranging as to limitation of membership. One of your most important points will be as to approaching the Government for a charter. You will have to bear in mind that a large element to be pondered will be the consideration of the public interest. This is a most important factor. I am sure I am speaking for every member of the Society of Chemical Industry when I express entire sympathy with your efforts to elevate your status with all concurrent advantages. If by any process of evolution the proposed body should become an integral part of the S.C.I. it would be a point gained. You would have the advantage of their fellowship and their support.

The resolution was then passed as follows:

"Resolved, that it is desirable to form an association of chemists and that the chairman nominate a committee to consider the matter and to report at a future meeting."

The chairman then nominated the following as members of the committee: Dr. Parker, Dr. McGill, Mr. Grageroff, Mr. Race, Prof. Ardagh, Dr. MacIntosh and Mr. Roast, with power to add to their number.

(The committee went into session and appointed Mr. Roast as secretary-treasurer. To defray the expenses of the committee, it was intimated that contributions would be received. The address of the secretary is: Harold J. Roast, 393 Guy Street, Montreal).

Afternoon Session

Mr. Fraser Keith (Secretary of the Canadian Society of Civil Engineers, now the Engineering Institute of Canada): Mr. Chairman,—At the request of the Council of the Engineering Institute of Canada I extend to you the right hand of fellowship on behalf of that body. Our organization has extended its scope somewhat, and it falls in connection with the chemists of Canada. We are all technical men together, and we are willing to co-operate in any way. Recently we have adopted new by-laws, and it is felt that we could not do better than co-operate with other technical men in Canada. We are on a par to some extent so far as technical education is concerned, and we wish to give you the benefit of our organization in any way that may be possible. (Applause).

The Chairman: We appreciate this kindly greeting of a sister society. Kindly convey to the members and council of the society our keen appreciation of your good-will, and assure them that our appreciation will take the form of unanimous co-operation in every possible way with the Institute of Engineers.

Ethyl Alcohol from Wood Waste

Mr. Geo. H. Tomlinson, of Niagara Falls, Ont., then read a paper on the "Present Status of the Industry of Ethyl Alcohol from Wood Waste," a supplement to the paper by the same author in The Canadian Chemical Journal for May.

Mr. Tomlinson predicted that the manufacture of ethyl alcohol would soon be a business of great industrial importance. Two such plants had been constructed in the United States within the past ten years, and have continuously operated producing a high grade alcohol at costs comparing well with those of other sources. The process there used is based on the fact that when wood is heated under pressure with a dilute hydrolyzing

acid a certain proportion is converted into glucose. As much as 25 to 28 per cent. of the anhydrous wood is rendered soluble, and of this amount as much as 80% can be delivered as fermentable sugar, though to accomplish this requires most careful control. It is not likely that a greater percentage will be obtained by the use of dilute acids. For the present, therefore, a conversion yielding 20 to 22% of fermentable sugars or from 10 to 11% of ethyl alcohol corresponding to a maximum of say 35 gallons of 95% alcohol per dry ton represents the immediate goal. On a large scale the actual average yields have hardly exceeded half of this amount so that there is a wide margin for improvement. Referring to the experiments of Alex Classen and the results obtained by heating commuted wood under pressure using dilute sulphurous acid, the author illustrated the results with the following example: Assuming an acid concentration of 1%, and that in one case we have a moisture rate of 100% and in another 400%, the total acid consumption in the second case would be four times, and the amount of heat in excess of three times that of the former. Since the acid must be neutralized the lime equivalent will be similarly increased. When the reaction is complete the sugars formed will be correspondingly diluted and probably require in the second case, some concentration. These points represent direct economy, but there are other factors of importance. The reaction itself requires careful control, especially as to temperature and time, so that the less water present the more quickly will temperature regulation be effected, and on this largely depends the yield. With the 100% moisture ratio the product is still below saturation limit, and the material can be handled on conveyors like the original sawdust, and the sugars extracted by diffusion as in the beet sugar process. But with a high moisture ratio the solids quickly settle down into a felt-like mass which nothing short of a hydraulic nozzle will likely remove.

Classen's failure to make his process a commercial success was due more to faulty engineering methods than to chemical factors. In operating an experimental plant in 1909 the author discovered that hydrochloric acid and sulphuric acid could be employed with similarly low moisture ratios. By using a volatile acid a uniform mixture and penetration of the wood was assured without which mechanical admixture would have been required. The best yield in using the different reagents was 23.1% fermentable with hydrochloric acid, and 22.96% with sulphurous acid. Since hydrochloric acid involves greater expense, however, the use of the sulphurous acid process may be anticipated.

As to apparatus employed, the digesters in which conversion is made are standard 14 ft. globe rotary bleaching boilers. These are protected on the inside with an acid-proof tile lining such as used in sulphite pulp digesters. This type gives easy filling and emptying and provides for means of agitation. The acid and steam are admitted through trunions. A turn-over of 80 to 100 tons of material per day can be realized from this equipment. The separation of the sugar from the woody residue is effected in a standard beet sugar diffusion battery provided with a lining similar to the digester lining. This gives great capacity with minimum labor, especially if there are convenient hoppers, chutes, etc., for handling. The fermenentation of the saccharine, the distillation of the beer and the rectification of the alcohol involve no new problem and the standard methods are used. Care must be taken, however, that hydrolysis is properly regulated to give the largest yield of fermentable sugar, and minimum of decomposition products, and even then undesirable secondary reactions may occur. The hydrolized product always contains a percentage of pyroligneous and intermediate products and in these unstable mixtures troubles occur. In dealing with large masses, unless special provision for rapid cooling is made, some quantities may retain a temperature near the boiling point for intervals, with liability for further reaction. The author believes that by applying a vacuum to the digester as soon as the primary reactions are complete the difficulty can be overcome, with the further advantage of removing much of the volatile organic acids that are always formed, and removing also the traces of sulphurous acid. The residue after the sugars are removed amounts to 70% of the original wood, which can be used as fuel. This improvement has been patented.

In January, 1913, spirits were first distilled at the second plant at Fullerton, La., controlled by the DuPont Company, and using the process described. Though working below capacity, the average cost per gallon was 36.48 cents. Taking one month, June of that year, the costs were made up as follows:

Materials and Labor Per Gallon	
Wood waste at 50 cents per cord	.051
Acid (H_2SO_4)	.019
Lime	.008
Malt Sprouts	.019
Molasses	.012
Glue	.002
Labor	.061
	.172

Other Items Per Gallon	
Superintendence	.014
Supplies	.013
Repairs	.019
Power and steam	.040
Depreciation	.032
Insurance	.004
Factory expense	.008
General	.003
	.133

Allowing .024 as the difference between costs of products in May and June this gives a total cost of .329 cents. It was estimated that if a monthly capacity of 100,000 gallons had been reached the cost would not have exceeded 21 cents per gallon as against 30 cents the cost of grain alcohol at the American distilleries at that date. Conditions were not favorable for production in 1913, but since the summer of 1916 the plant has been running continuously, taking advantage of the high prices ruling.

The quality of the product at Fullerton was reported upon as one of the purest cologne spirits that had come under the observation of the analyst. If the cost of production would be higher than in 1913 then the fact that alcohol from either grain or molasses is more than double the price of that year would still leave the advantage in favor of the product from wood waste As the sugars used in wood alcohol can be used for feeding animals, as is done with cane molasses, there would seem to be great possibilities here. The author thinks that wood molasses can be produced at 4 to 6 cents per gallon. The gallons referred to in each case mean U.S. wine gallons.

In reply to questions Mr. Tomlinson stated that yellow pine was employed almost exclusively in the manufacture of wood alcohol in the Southern States, but experiments with white pine, spruce, and fir gave about the same results.

Dr. Bates: It depends so largely upon technical control that it requires an expert to make it a commercial success. A complicated apparatus is required for converting wood into sugar. My impression is that methyl alcohol is present, where wood is treated with sulphur dioxide, to the extent of ½ to 3 or 4%. Considering Canada in relation to the histologene process large quantities of wood waste would be necessary. We should consider British Columbia as a logical starting point for this process, because several hundred tons per day of wood waste would be necessary to establish the process on a proper commercial scale. It is possible to increase the proportion of sugar by modifying the direct cooking process, and by the condensation of the liquor for a length of time. It must be carried out in connection with pulp-making operations.

Mr. Tomlinson: I have no knowledge of anything being done with the woods of British Columbia. It has been discussed, but so far as I know there is nothing in sight.

The Chairman: It is interesting to have the author of the process with us to lay it before us. One interesting point to me is that as formerly only the red pine of the South was considered fit for this process, it is now shown that our white pine will do as well, and this opens up an opportunity for us to utilize our sawdust.

Mr. Tomlinson: As for resins, they can be obtained from the white pine as well as from the yellow pine—there is practically no difference in the process for the two, except that in the one case there is considerably more turpentine.

The Chairman: The chemical committee has passed a resolution showing the desirability of having industrial alcohol duty free for the needs of manufacturing chemists in particular. The reasons were set forth in full by myself. I would like you to consider whether you should discuss the question of industrial alcohol with a view to its being considered by the present government. One reason is that owing to recent legislation in this country we are practically a dry country, the distilleries hitherto occupied in the production of industrial and potable spirits are to all intents and purposes closed. They are only kept open for the purposes of the Imperial Munitions Board, and potable alcohol is not made at all. The aniline industry originated in England, but after struggling for some years it was transferred to Germany and Switzerland where alcohol was more accessible. If you would agree to such a resolution I would be glad if you would kindly say Yes or No. The substance of the resolution is this:

Whereas a great many nations have been industrially helped to a very large extent by the fact that they have industrial alcohol excise and duty free, and as Canada possesses none of this spirit for industrial development, and as prohibition no longer allows of a revenue from the import of alcohol; and whereas it is desirable that we should have this new source of motor fuel, presenting a unique opportunity to bring about the development of our industries by duty-free alcohol, and as a great many distilleries are closed, involving a distinct loss to the community if stopped altogether, it is desirable that the government should consider some measure of duty-free alcohol, which at one and the same time would protect the revenue and safeguard the public interest.

In reply to the question of a member as to whether the lowering of the excise duty in the United States would mean that all our future supply of alcohol would come from there and prevent the establishment of industrial alcohol plants in Canada if our excise duty were not likewise lowered, the chairman said the resolution would include both duties. We wish to keep the distilleries employed in the production of industrial alcohol, especially as we are beginning to make it out of inedible materials. The desire is primarily to preserve the alcohol industry and help other industries.

Dr. Bates: It seems to me you want to remove the excise duty, but in some degree preserve the customs duty thereby leaving a source of revenue to the government, and some protection to those who are making alcohol in this country.

The Chairman: The recommendation is this: The government should consider the question of duty-free alcohol for industries. This is a far more important point than one would think. It is stated in the resolution that the revenue should be protected. We ought in some measure to protect the distilleries of Canada, for they have their plants erected, and might be even encouraged to extend It might be a small duty, it might be a big one, but we want an alcohol which would enable us to compete with other nations. We can buy fine pure chemicals in Germany, in England, or the United States, at less cost laid down duty paid than it would cost to make them ourselves. This is one thing the manufacturing chemist is up against all the time.

It was moved and seconded that the government be petitioned to take into consideration the question of duty-free alcohol with a view to future action.

Standardization of Benzine and Gasoline

Dr. A. McGill: I have no paper prepared, but I can not better indicate the importance of the subject than by making way for a gentleman who is specially qualified to speak on motor fuels, and along with the rest of you I expect to learn very much. Motor fuels are largely used in internal combustion engines. The internal combustion engine differs from the steam engine in this, that instead of gradually introducing the motive power already generated, by pressure given the steam on tap, the cylinder has introduced into it an explosive mixture of two hydro-carbons ignited by means of an electric spark. Instead of a gradually continued pressure there is an explosive force. In order that the explosion may be complete, you will recognize the necessity of having an explosive mixture in the form of gas, and the gas is more or less compressed. What hydro-carbons must be had in order to get the right effect is a matter of moment. Ordinary coal gas may answer the purpose. I am a little surprised that it has not been utilized for motor-cars. Under a pressure of 120 atmospheres it could be utilized for hydro-carbons combining in the cylinders. It is quite evident that whatever hydro-carbons are used they must be in portable form, not gas under great pressure or potential gas in liquid form. The lighter parts of crude oil have also been used. Crude oil is a mixture of hydro-carbons. In different fields the proportion of these hydro-carbons differs very much. If we want the explosions to occur at an ordinary temperature we can only utilize such portions of the crude oil as are represented by hexylene or oxolene combinations; for higher values, you must get it in proper gas form. While the demand for motor fuel of this kind was very limited, it was possible to supply it. But the demand has so largely increased to-day that it is quite impossible to fill it with the available crude oil. Several processes have been devised for the purpose of making available hydro-carbons where "n" is of sufficiently high-value—of these the cracking process is the most important. The gasoline of to-day is not the same as in the early days of the internal combustion engine. There has come into recognition another product, benzine, largely manufactured now in connection with toluene. Benzine's boiling point is 78 to 80 degrees Centigrade. It is a very important component of the gasoline of to-day. Motor fuel in its passage through the carburetor must be converted into a gaseous condition to effect a proper explosion. Gasoline that gives good results in summer may sometimes be found useless for motor driving in winter. Complaints have come from this cause from those who think we are responsible for the character of the petroleum. It is true that an Act was passed many years ago, but it had no such intent as to regulate the hydro-carbons in this way. The object of the Petroleum Act was to prevent danger from volatile hydro-carbons for household lighting. The conditions are entirely reversed to-day. The demand is for the light boiling article instead of the domestic kerosene. We are very likely to find too high a percentage of light-boiling products. This is the cause of a long series of complaints to the department of Inland Revenue. We are asked to standardize the motor-fuel, so that the purchaser may get something which will be sure to make his motor go. So far as available under properly defined conditions I do not know that there is any so-called gasoline in the market that is not of high value as fuel. But the user must know how to take advantage of it, how to handle it. Many men run their cars on ordinary kerosene. The public demands that the government establish a standard grade of motor-fuel, which shall, under ordinary conditions, give the user satisfaction. I have given much time and study to the commercial gasolines on the market, and I have presented a report containing data of interest. In conversation with Mr. Larmour, of the Bureau of Mines, Washington, and others in control of the fuels of the United States and Canada, I have

come to the conclusion that it would be quite possible to draw up a constant for a type of gasoline that would give no trouble to anybody. My idea is that there can be no question of interfering with the sale of the gasoline on the market to-day, as it fulfils all the proper conditions as a desirable and effective fuel. What I suggested has not taken any legal form, but my suggestion was to draw up a standard based upon the boiling point of a material for gasoline that would give effective service, throwing it upon the manufacturer to describe any gasoline meeting the government requirements as of government standard. He may manufacture any other kind if he likes, but the immediate object of my suggestion is to meet the complaints of those who find more or less difficulty in utilizing the article available today. This subject is a technical one. I should very much dislike to draw up a constant for a type of gasoline difficult to produce, or that perhaps could not be produced in sufficient quantities. We don't want to do this. We want to give any producer the right to get out a fuel like this. There can be no doubt that critical buyers would be willing to pay a higher price for such an article, if it were guaranteed as of government standard. There are men here who have had long experience in this matter. These gentlemen have a much better right to speak in detail on this subject, for, whereas I speak from an academic point of view, they can speak from the point of view of actual production.

Mr. W. A. P. Schorman: Dr. McGill has quite thoroughly covered the necessity of doing something in the way of protecting the public by means of defining gasoline. I am speaking to you now from the refiner's view-point, and I am going back twenty-five years to the time when I was first initiated into the refining industry. There was then what was known as the 72 gravity stove gasoline. I remember going through the Western States, which was a great field of oil consumption, because everyone there had a summer kitchen with a gasoline stove. They did not like the coal or wood stoves. The gravity had been set at 70 or 72 because Pennsylvania was the source of production. It might interest you also to learn that I tried to sell it at six cents a gallon! These were the days for the joy-riders, but unfortunately the joy-waggon was absent. A few years ago it became necessary to get more gasoline from crude petroleum. Modifications in the internal combustion engine suggested that something must be done. A heavier motor-fuel was desired. A great deal of experimental work was done by Burton and others, but most of the results were commercial failures. Burton sold his oil three cents below tank waggon price, but as it was dirty and foul-smelling nobody wanted to use it. It became necessary to spend a great deal of time and money on experimental work to produce what is known to-day as "cracked gasoline." I have done considerable work along that line myself, and we hope to be able to produce gasoline equal to that produced from fractional distillation of crude petroleum. We have arrived at the point where we must lay aside the idea that gasoline must be defined as to its value by its weight. We buy 64 or 72 gasoline, but this tells us absolutely nothing as far as the quality of the product is concerned. We must get away from this. It has been a hard, uphill fight. It is hard for the producer to tell the public the qualitty in a measure according to weight. I have some interesting figures here for the cracked process I am using. I produce gasoline 52 Baumé. Some would say that is coal oil—I would not use it. These are tests that determine its quality, gravity from 52 to 54.3. I have one with an initial boiling point of 106; 20% over at 208; 60% over at 304; 90% over at 370 Fahrenheit. There is only one difficulty in connection with cracked gasoline. We have been unable to eliminate the olefine. Most of the cracked gasoline contains 22 to 24% of olefine, for which the standard carburetor does not give sufficient oxygen for perfect combustion. It may also interest you to learn that it costs us between 39 and 40 cents a gallon to produce it, while the tank waggon price is 31 cents. It is hard to put it on a commercial basis. We find that the method of testing gasoline is not uniform. This was clearly brought out a few months ago, when ten different results were obtained from a sample sent to ten different laboratories. So long as the personal equation enters into the subject we will have variable results. Some automatic device must be made in order to have uniform results from tests. As regards the heavy gasoline from the cracking process—there is in the minds of all men who drive motor cars (all Canadian chemists own motor cars)—(laughter)—this objection to heavy fuels. We cling to the idea of gravity. When, a year ago, at a meeting of our sales organization, I said that it was time the public should know that gravity denotes absolutely nothing with reference to the quality of gasoline, all began to shake in their shoes—they thought I was going to "put something over them." Without their knowledge I put some of this 53.2 gravity gasoline into their cars. They all came back for more. It had "kick" in it, they said. When I told them what it was they thought I was fooling them. When I weighed it in their presence they were satisfied. They have more confidence now in this gasoline made by the cracking process. One chauffeur who drove a seven passenger car was rather critical. I said to him: "Load up that car with heavy men." He put in seven men who weighed over 190 pounds each. He got more mileage per gallon by following instructions, to increase the amount of oxygen, but what pleased him most was that he took the load over a rough road at a speed of only two miles per hour on high gear. As refiners we welcome the idea of a standard gasoline. There is a pure food law to protect the purchaser by making sure that he is going to get a pound of butter when he pays for that quantity. And when he goes to the garage to buy gasoline he should not get half gasoline and half coal oil. We discovered in following up our trade in which we market two grades of gasoline that one dealer was selling our regular motor grade at three cents a gallon higher than the market price, and we found that our trade name for a product was being used by dealers who were not even our customers. It is up to the government to protect the public against that kind of fraud. We are willing to lend our aid to the government in defining a satisfactory motor fuel so that a man going to the garage to buy gasoline will be sure to obtain a government standard article that is sure to give the satisfactory service that he is entitled to. But the present law is very unsatisfactory. Take our importation law. It may be interesting to you to know that about sixty per cent. of the gasoline used in Canada is imported. We cannot import any gasoline free above .725, except by paying 7½% war tax. On anything above that weight the public must pay 2½ cents per gallon duty. The government needs money badly. We feel that the law should be changed. There should be some other method of equalizing the revenue without reducing it, but there should be some other method of test. As for the distillation test, gasoline should have a certain initial boiling point, so that on a cold morning if you have a Ford without a self-starter you won't have to crank it for fifteen minutes. You need a motor fuel which must have a certain initial boiling point. It should distil at least 50% below 300 degrees Fahrenheit. For this reason we find in experimental work that if 60% of the gasoline distils over at or below 300 Fahrenheit, it will give an instant explosion under pressure. The balance will burn during the expansion period and give kick to the piston, on the same principle that powder is graded as to time of burning, some of the powder charge burning after the explosion which starts the projectile and keeps on burning while the projectile passes through the gun. This produces the high muzzle velocity. The same is true of gasoline. The entire volume does not burn instantly. Some of it burns through the expansion period, giving more power. At least 60% should distil at 300 degrees in order to give the necessary power, to begin with, and all gasoline should have an initial boiling-point of 100 Fahrenheit or below that for easy starting. I hope to see the time when these regulations will

pass. The public is entitled to that protection, and we as manufacturers will be only too glad to see the public protected in that way.

Mr. Stephenson: The question came up a few years ago. Where a specific gravity of 62 was claimed, I found that some contained from 30 to 40% of another substance. It is easy to make light and heavy gasoline. As for the statement of .720, the Customs Act says .725. I had one last week of .639.

Mr. Schorman: The law is .725 or under. We make a heavier gasoline which is very satisfactory and which proved more than anything else that the gravity test should be discarded with reference to the quality of the gasoline. You can blend successfully. 78-84 Baumé gravity casing head gasoline is blended with kerosene in the Western States. Blending should be done so as to avoid stratification. Take a tank of blended gasoline where the gasoline is a casing head gasoline produced by the compression system, and blended with a heavier product. In a short time it will stratify. Take a sample from the bottom—it will be about 48 gravity; at the top it will be 72 gravity. But that kind of blend will not answer the distillation test that I have suggested this afternoon, because 95% will not distil at 400 Fahrenheit. That is why the public should be protected by a distillation test. This test would require a special apparatus which has only recently been devised by the United States Bureau of Standards, and I think is going to be adopted here. This apparatus is being used every day by manufacturing chemists. The government employs inspectors who visit the refineries and make gravity tests daily.

Dr. MacLaurin: The question of standardization is an important one. I have taken a great deal of interest in it during the last few years. In the West we have a large number of plants. I took occasion some years ago to make a number of distillations. I found the percentage of kerosene to vary from 18 to 46. All these had passed the Customs as having a specific gravity essentially the same. It shows that specific gravity tests are absolutely useless. I also agree that volatility is evidently the standard upon which to base quality. Not only is standard gas important to us, but the problem of its production in Canada is an extremely important one. At the present time the United States produces 70% of the total world's product of crude petroleum. The Central Powers at the present time control the larger part of the petroleum supplies of Europe. Mexico produces 8%. In Canada we produce about 5% of the total world's supply. At the present time the Allies are dependent upon the United States for oil. The same is true of all our war vessels, aeroplanes, and transportation. Great Britain has decided to expend $2,500,000 prospecting for oil in that country. In the United States the two chief fields are the mid-continent field and the California field. It has been estimated that the American fields will last only twenty-two to twenty-seven years. They are not inexhaustible, a most important problem. I might also add that the American field extends into Saskatchewan and Northern Alberta, where according to the geological reports, there are strong indications of oil. Wells have been bored and there is considerable promise. In view of the fact that the Allies are entirely dependent on the United States for oil, it would be advisable for the Dominion Government to negotiate for the development of these Canadian oil fields.

Mr. Schorman: Don't be frightened about the exhaustion of the oil fields. There are all kinds of oil yet to be extracted. True, it is not in British territory, but there is abundance of it in sight, which needs only to be tapped. One correction I wish to make—the entire British navy gets its oil fuel from the oil field of Tampico, Mexico. As far as the supply is concerned there is abundance of it. One well is known to yield 125,000 barrels daily. The only thing I wish to call attention to is that Carranza, in my opinion, is just as pro-German as ever. German spies and German propaganda are running wild in Mexico. Carranza allows wireless to be constructed under his very nose. I don't think that is showing friendship for the Allies or for their interests.

Dr. MacLaurin: The United States geological report for 1914 shows that in that year that country produced 266,000,000 barrels, while Mexico produced only 21,000,000. I would call attention to the fact that it is doubtful who is going to control the Mexican supply.

The Chairman: While consideration of that point is of considerable interest it is beyond the line of discussion. We can safely leave the matter with Dr. McGill if a resolution is not desirable in the matter.

Alfred Burton, Hon. Sec., S.C.I.

The applause that always greeted the mention of his name during the convention was an eloquent tribute to the value of the long and self-denying services to the Society of Chemical Industry in Canada rendered by Mr. Alfred Burton the Honorary Secretary.

The meeting considered it eminently fitting to recognize the long services of Mr. Alfred Burton as secretary of the Society of Chemical Industry by appointing him a member of the committee formed in response to Mr. Pirrie's memorandum. It was recalled that Mr. Burton had been secretary since the inception of the Society in 1901, and has been in intimate contact with chemists all over Canada.

Essential Chemical Industries and the War

Dr. Bain: Mr. Pirrie has spoken to me on a subject which he has been considering very thoroughly, and as he is unable to be present he has asked me to read the following memorandum which he has drawn up, dealing with a subject very close to the hearts of many of us—the relation of our young chemists to military service.

Memorandum: There are certain industries in Canada which are essential for the successful prosecution of the war, such for example, as explosives, propellants, steel, alloys, medicinal, non-ferrous metals, etc., while other industries are producing articles which, though non-essential, are important. Whilst one realizes that the chemist is a very important asset to the country, not only during the war but during the period of industrial reorganization which will follow, it must not be forgotten that man power is at the present time the most urgent need of the Allied Powers, and therefore it is the duty of em-

ployers to release chemists wherever possible. There are certain indutries, however, which cannot operate without chemical control; there are other industries that can operate but so inefficiently that they will be almost hopelessly crippled, whilst certain industries can continue without chemists if they have to, though it involves producing at much higher cost through wastage, etc. Until the passing of the amendment to the Order-in-Council calling up everyone between 19 and 23 years of age, the military authorities granted leave of absence without pay to all enlisted chemists whilst employed by the Imperial Munitions Board on condition that they be returned to the militia authorities should the Board dispense with their services. This still holds good in the case of all men not falling within the 19 to 23 category. Whilst this is of assistance to the Imperial Munitions Board in the operation of their national plants, and to the Minister of Munitions for inspection purposes, it removes junior chemists who are required for routine control work and in no way assists other manufacturers.

Therefore, I wish to propose that a memorial be prepared by the chemists now assembled to be presented to the Privy Council drawing their attention to the situation. And furthermore, that a committee be formed of say three members, preferably resident in Ottawa, representing we will say explosives, steel, and general industries; and that the services of this committee be offered to the Dominion Government in advising upon the case of every chemist called upon for military service, the committee to go thoroughly into each case and only to recommend to the military authorities that leave of absence be granted to men who, in their opinion, it is absolutely necessary for a certain manufacturer or industry to retain. If the Dominion Government will accept the services of such committee it is suggested that the following procedure be followed:

Every manufacturer desiring the return to him of a chemist who has enlisted and not yet gone overseas, shall make application stating his case fully and the committee will investigate along the following lines:

1. Is the industry in question of vital importance?
2. Are the particular qualifications of the chemist such that he cannot be replaced without seriously jeopardizing production of the plant?
3. If such a man can be replaced can the committee recommend a man capable of filling such a position who, we will say, is physically not so suitable to proceed overseas?

Dr. Bain: It is the duty of employers to release chemists wherever possible. But some industries are of a kind apart. Chemists have been loaned to the Munitions Board, on condition that they be returned. Mr. Pirrie asks that the chemists form a committee in conjunction with the Explosives, Steel and General Industries and that this committee offer its services to the Dominion Government to jointly consider the case of every chemist called for military service, and ask for leave of absence for such men as it is absolutely necessary to retain. I would call attention to the anomalous conditions under which skilled men are taken from their work and sent overseas.

Dr. Bain then moved, seconded by Dean Goodwin, that the following committee be appointed to prepare a memorial to be submitted to the Privy Council calling their attention to the serious situation arising from the immediate withdrawal of chemists for overseas service, and that they be authorized to represent this Society as a committee to co-operate with the Government and consider applications from manufacturers and to investigate each individual case before recommending that leave of absence be granted, the committee to consist of Mr. Noble W. Pirrie, Mr. A. Burton and Mr. J. R. Donald.

The motion was carried.

Resolution on Technical Education

Mr. T. Linsey Crossley: A Royal Commission on the subject of technical education was formed by Order in Council on January 1, 1910. This Commission in its report, presented to the Dominion Parliament, recommended that a system of technical education should be established under provincial control. The Government was asked to institute technical training and the Canadian Manufacturers' Association was asked to cooperate. But the Government has time for other discussions of less value, on one of which they nearly went on the rocks recently. A discussion on education would be more productive of results in preventing waste of food, loss of lumber by fires, etc. The loss from fires is infinitely greater than in any other civilized country. These are all hindrances to the prosecution of the war. Some object that provincial rights are infringed by the Dominion taking these steps, but the British North America Act secures provincial control with Dominion financing when the latter is advisable. We are told that there are more urgent problems—strikes, transportation, etc. The labor men are hampered by the lack of technical education. Can not we approach these men? There is an opportunity to cut out a good deal of the useless work in the curriculum of the schools, and doing more work for the national service. We should get in touch with the local inspectors, especially in industrial districts. We could thus have more time allotted to the study of subjects that have a bearing on local industries. In small communities great numbers of these pupils will eventually find employment in these industries. Each one could be made a centre for night school work in connection with their particular industry. The Pulp and Paper Association now have two schools which are partly under their own control. One at Thorold now has been running two years. They have taken up electricity, mechanical drawing, physics, chemistry and science. Cooking is taught the young women, also sewing. At Hawkesbury the Riordon Paper Mills have a school of fifty to seventy students entirely under their own control—there is not much red tape there!

There is a condition in society and industry to-day which in spite of all the work on technical education, welfare and safety, is still the cause of enormous waste of time, material and man power; that is the unsatisfactory relation between labor and capital of which the extremes are the exploitation of labor by capital and the bullying of capital by labor. A more intellectual appreciation of the rights and privileges of either by both parties promises to solve the problem. The grasping capitalist and the bullying laborer are both suffering from the same disease. They need the same medicine,—adequate education. Until recently the prognosis was unfavorable. Now conditions indicate that the cure is possible but in most cases will take time, running through generations like the development of the seedless orange.

Mr. Crossley then read the resolution adopted by the Technical Section of the Pulp and Paper Association, stating that after the war intensive technical education will be more urgent than ever; that the lack of technically trained men is one of the serious handicaps of Canada in the present emergencies; that the Government be urged to put a comprehensive national system of technical education into operation without delay, and that other organizations be asked to co-operate.

Mr. Crossley disposed of all the objections that have been raised against making a start in industrial and technical training. One of these was that nothing could be done in time to affect the present issue; but he pointed out that in three or four months the schools of Canada will start their winter sessions, and that by that time every school could have ready programmes that would cut out useless work and introduce the practical essentials; that the Federal Educational Association could nominate inter-provincial committees who could make a start giving district inspectors some freedom in carrying out plans.

He then moved the following resolution:

"Whereas the prosecution of the war in this country has been and is subject to disturbances due to industrial unrest, and

"Whereas industrial unrest is largely due to the fact that neither party in labor disputes has been fittingly educated for action with a sense of national service;

"Be it resolved that the Chemists of Canada assembled at Ottawa, May 22, 1918, do hereby urge the Government of Canada to take some immediate steps towards the adoption of a uniform interprovincial system of primary education and in the meantime to take action on the excellent report of the Royal Commission on Industrial Training and Technical Education, and further

"Be it resolved that the Secretary of this Convention notify the Secretaries of the Canadian Mining Institute, the Canadian Pulp & Paper Association, and Textile Institute, that the Chemists of Canada will gladly co-operate in any action to these ends."

Dean Goodwin (Queen's): I entirely agree with these statements and second the resolution. I trust we will have a national system of technical education instead of the sporadic efforts here and there now obtaining. We need a widespread national system of technical education, not necessarily uniform. Probably attempts at uniformity have had a great deal to do with our previous failures. The system should be adapted to the community.

The resolution was adopted without dissent.

Dr. Alfred Tingle, of the Department of Customs, Ottawa, read a paper on "The Hydrated Forms of Normal Barium Sulphate." He stated that, while it is generally assumed that precipitated barium sulphate is, like natural barite, an anhydrous compound, he has found it to be hydrated. Three distinct hydrates were obtained, differing in their physical properties: (1) the deci-hydrate 10 $BaSO_4$, H_2O precipitated from hot neutral solutions, (ii) the deci-di-hydrate 10 $BaSO_4$, 2 H_2O, from hot acid solutions, and (iii) the deci-tetra hydrate 10 $BaSO_4$, 4 H_2O, from cold acid solutions. The first two are stable at 120°, but the third slowly loses water at that temperature. These compounds must be heated almost to redness to be wholly dehydrated. In these experiments due care was taken to avoid reduction by flame gases and loss of sulphur trioxide, phenomena observed by previous workers.

Dr. Tingle suggested that the presence of water of constitution furnishes an analytical criterion whereby the "blanc fixe" of commerce may be distinguished from very finely ground barite, and that the amount of water of constitution found may be a guide to the "covering power" of the barium sulphate when used as a paint.

Dr. H. S. Davis, of the University of Manitoba, read a paper on "Recovery of Light Oils from Gases." This will be dealt with in another issue.

A paper by Dr. J. T. Birchard on a "Standard Method of Estimating Moisture in Wheat" was read by title.

In the afternoon members were invited to join the Chemical Section of the Royal Society of Canada, in session in another part of the Chateau Laurier under the chairmanship of Dr. Frank Shutt, chief chemist at the Experimental Farms.

An informal dinner took place in the evening at the Chateau and was enjoyed by a large company.

The Dinner

After the toast to the King, Mr. Wardleworth as chairman, congratulated the Society on the success of the convention, the attendance having proved to be more than twice as large as anticipated. In welcoming ladies at this gathering he noted that there was among them at least one lady research chemist. It was a hopeful sign to see representatives all the way from British Columbia and Manitoba, and he trusted that the recently formed Manitoba Chemical Society would become a part of this Society. In regard to the progress of chemistry in Canada the day of hesitation is past, and he could resign the presidency into new hands with the certainty of the continuance of the great progress that had been made since he became chairman. For what success had been achieved in Canada he paid a tribute to Mr. Burton whose self-denying work and patience in the years of struggle should be remembered. There was a notion in some quarters that Toronto had been predominant in the affairs of the society at large, but it should not be forgotten that when the Montreal Section was started the Toronto Section surrendered half of its membership in the Council, and later when the Ottawa Section was established the membership allotted to Ottawa was taken from Toronto. Toronto had never fettered, but always encouraged the evolution of the society, and we have thus a practically new institution to-day. The autonomous character of the Sections will encourage further growth on the freest lines, and much of the development is due to Mr. Burton. If the same spirit is maintained the future is assured, and chemistry and chemical engineering will be a dominating influence in the country. In conclusion he conveyed the thanks of the society to the city council, through the mayor, for a grant made for the convention.

Mayor Fisher expressed his pleasure in being present, and he could add his personal testimony to the new apprehension of the service of chemistry in public affairs as well as in industry. The city of Ottawa had established its own laboratory and already it had resulted in new economies and added efficiency in the city's business.

The secretary read letters of regret from many who had been unable to attend, among them being Mr. Chadsey, the chairman of the Toronto Section.

Dean Ellis, of the Applied Science Department, of the University of Toronto, expressed his regret at the absence from the company of Mr. Van der Linde, and Col. W. R. Lang, who were among the founders of the society. Col. Lang was now in Halifax.

Consultation Committee

The secretary then read a letter from Sir George E. Foster, Minister of Trade and Commerce, addressed to the convention as follows:

"I note by the papers that it is contemplated to form a national Society or Association of Chemists, or of Chemical Industry, and if that rumor be true I would like to suggest to the society when formed, that it should appoint a small but representative committee with whom the Government would be able to consult in relation to the solution of the great national problems which are facing us and in which chemists must necessarily play a very important part. The Government, and my department particularly, finds it difficult at times to get consultations with representatives of the chemical industry, in order to obtain information or get advice with reference to matters which are continually coming before it, and it would facilitate the work of the Government very much if it had the names of a representative committee with whom it could confer and which it could call into consultation when necessity arises. I venture to commend this to the attention of the Canadian Association."

The letter was received with applause and it was decided to take action upon it, Dean Goodwin, Mr. Wardleworth and Dr. Frank Shutt being nominated the advisory committee.

Dean Goodwin, as president elect, was then called upon, and said that after such a period of growth as had taken place under Mr. Wardleworth he accepted the position with fear and trembling for himself, but he would do his best. With the conviction that the chemists are a new power in the nation and assured of a maintenance of the spirit of the past year, there was every encouragement for the coming year. They must unite to make the society as useful as possible, seeing that the progress of the nation depends more on chemistry than on any one science.

Dr. Parker, of Winnipeg, suggested that the society should appoint a small committee whose function should be to confer with the Royal Society of Canada on matters of scientific and public interest. He would take occasion also to report that the committee appointed to consider the formation of an association

of chemists had already met and made progress. There would be no difficulty on the question of eligibility to membership. On motion of Dr. Parker, Dr. J. Watson Bain and Mr. Theo. H. Wardleworth were nominated as the committee to confer with a committee of the Royal Society.

Mr. Burton presented his report in the form of some observations on:

Essential Chemical Industries

The manufactures in Canada before the war were mostly staple, but during the war under the compelling stress of dire necessity we have advanced considerably in the manufacture of the essential chemical industries which are the foundation upon which all other chemical endeavor is based, and without which we could not carry on the war.

Let us trust that in developing the means of destruction of our enemies that we will eventually ensure in the interests of peace the future position of our chemical industries for the good of those who come after us.

We all recognize that our country is passing through a critical period, and the manner in which we shall emerge will depend upon how successfully we can apply the lessons now being taught us. We see evidence everywhere about us, evidences of co-operation, of standardization and organization, and we are proud to feel that the increase in efficiency of our industries has been due in no small measure to our business men closely related with the competency of our university-trained men; for the development of manufacturing is co-related to the growth in science applied.

Chemistry is written large in the public eye to-day and has received full recognition for all time of its service to the nation and its assistance to win the war. We expect of our Government, a Union Government, which we have unitedly placed in power, to fully recognize this value, and under wise leadership to co-relate our efforts to render those problems most effective in the service of our country.

Some say what is needed to build up Canada is men. I feel we need manhood, and what will develop manhood more than industry?

An outstanding feature of this war so far as Canada is concerned, is that her war burden has been lighter than that of our Allies, owing chiefly to our geographical position. We have benefited greatly financially, and in our trade expansion, and suffered least amongst the belligerents. We were not prepared to grasp this opportunity. Our industry lacked capacity to cope with the situation, our capitalists were reluctant to invest their money. Notwithstanding these circumstances war demands brought a veritable boom to our industries. Though we lack raw materials for some of our industries, we can take them in exchange for our staple lines of export.

It is idle to assume that we can hold all our gains after the war. Undoubtedly we will be poorer after the war, in the sense at least of having expended large resources in the conflict and of having incurred an increased national debt. Like all countries undergoing a transition from an agricultural to an industrial state, we have been greatly dependent upon foreign capital to assist in the expansion of our industries. The war has built the latter up into sturdy youngsters and we trust they will not show signs of early mortality and that healthy reserves are going into the businesses, so as to make our country self-contained and hold that which we have got.

The essential fact is, can the considerations of general national development and preparedness for national defense be given their proper weight if left to private enterprise? To build up our industries we have one of two methods readily available, the tariff or the bonus. The former if not scientifically adjusted falls heavy on the consumer, while the other may fail of its object. The Government might step in here to maintain our essential chemical industries under some form of partnership agreement to supply so much of the needed capital as could not be assured a pecuniary return (allowing a preferential charge on such part of the capital as is provided by the public.) When the total net income exceeds the required preferential claims a fair interest could be paid on the government investment, and if a surplus was still available it could be divided pro rata between both public and preferential claims and government investment.

Hardwood Distillation Industry

Mr. M. L. Davies, vice-president and general manager of the Standard Chemical, Iron & Lumber Company, was then called on to make some observations on the Hardwood Distillation Industry of Canada.

Mr. Davies said it would be interesting to note that it was first established in Canada some twenty years ago in a small plant at Fenelon Falls, Ont., having a capacity of 20 cords or approximately 40 tons of hardwood per 24 hours. The industry has steadily grown and to-day there are twelve plants in Canada with a total carbonizing capacity of over 500 cords or 1,000 tons of hardwood per 24 hours. From this raw material we have a production of:

75,000 tons of Charcoal, used for smelting and fuel purposes
13,000 tons of Acetate of Lime, required for Acetone and Acetic Acid.
1,250,000 gallons of Methyl Alcohol, required for varnishes, soap, methylated spirits, etc.

Among other derivatives are Acetone Oils, Formaldehyde, Acetic Anhydride, Methyl Acetate and Sodium Acetate, the last three being new products in Canada since the beginning of the war. While the war has increased the demand for some of the wood chemicals, it is not anticipated that the Canadian products will be seriously affected by the cessation of hostilities as a considerable proportion of some of them found a ready market in foreign countries prior to the war. There is, however, room in this industry, like most others, for improvement. Both employer and employee labor often under great difficulty owing to the lack of technical training. It is impossible to secure the best results when workmen do not understand the importance of the instructions received from expert managers, chemists and engineers. For instance, in his opinion, it is just as necessary for the man firing a steam boiler to be trained in the elementary principles of combustion as it is for the man laying transmission lines to know the first principles of electricity. If the man attending the steam engine were versed in the elementary principles of mechanics, or the still-man had a correct vision of the elementary principles of distillation, or the furnace-man had a keen sense of the effect of varying temperatures upon operations, we should have increased production, better efficiency, and lower costs.

The lack of such knowledge means a distinct loss to the workman, the manufacturer and the country. It is not necessary to emphasize to a meeting of chemists the necessity for technical education. While there are technical schools in centres like Montreal and Toronto, there is, so far as he was aware, no method employed to reach the people in the rural districts. We have the machinery but not the facilities to set the same in motion. It would not be difficult to adopt the English system of science and art classes supported by the Government and the City and Guilds of London who provide travelling as well as resident lecturers. This system takes the form of evening classes at a nominal fee, with one lecture a week during the winter. Many subjects are taught but he referred principally to studies in elementary chemistry, electricity, mechanics, building construction, fuel and steam. The boys from the factories attend these lectures in large numbers.

Canada owes a duty to the rising generation to satisfy the ambition of every working boy and young man in our factories, i.e., the desire for progress both mental and financial. The technical knowledge of a process would undoubtedly produce greater interest and consequently greater care which would result in larger remuneration. With our wonderful natural resources we should not rest until the standard of technical

education is of the highest order to enable Canada to rank with the leading industrial countries of the world.

Approving of the ideas set forth by Mr. Davies, Mr. F. J. Hambly, of Buckingham, Que., referred to the great possibilities of electro-chemistry in Canada owing to its primary advantages in the vast water powers, which working twenty-four hours per day can yield ninety per cent. in efficiency, as against fifty per cent. or less by other means. Another advantage Canada has is in the great variety of its mineral deposits; but if the full benefit of these assets is to be reaped they should not be weighted down by losses in hauling materials back and forth in the processes of manufacture. For these reasons places like Niagara, Shawinigan Falls, Montreal and Quebec have great present advantages as seats of electro-chemical industries.

Mr. W. A. Allen, of Watson, Jack & Company, recalled the position which Germany had occupied in the chemical and color industries before the war, and how since then great industries sprang up over night, not only in Great Britain, Italy and Japan, but in the United States and Canada. He pointed out the conditions under which the capital, which had been so freely embarked in these industries, on this continent, should be secured in the maintenance of chemical manufactures after the war.

Mr. J. N. Stephenson, editor Pulp and Paper Magazine, called attention to the fact that the pulp and paper industry of Canada is now third, and may soon be second in importance in the value of exports; and that it was more definitely based on a chemical foundation than many chemists realized. Chemical problems faced the pulp and paper manufacturer at every stage. Mr. Stephenson's outline of these problems will appear in another issue.

Dr. J. Watson Bain, of the Canadian War Mission at Washington, said the chemist had come into his own in the United States. In the comprehensive organization of the war industries under government auspices every problem came back, directly or indirectly, for solution by the chemist. In the great stress of these "spacious days" no group of scientists had been so constantly consulted, and this was manifest when the important work of making an inventory of the national resources for war was taken in hand. Dr. Bain referred to the trade inconveniences caused by cutting out imports and exports of certain articles—such for example as trade in potash salts—when the war trade board got to work, but there was a manifest desire to be fair in deciding what was essential and what non-essential in organizing United States industries into war work. The moral for Canada was to produce at home more potash, tanning extracts, nitrates, etc., for just now we are in a water-tight compartment. We are now bringing our nitrates all the way from Chili, whereas, if some of our great water powers were utilized for the purpose we could soon be supplying not only all we needed for home consumption but exporting to other countries. There is now too great a gap between chemistry and business, and the chemist in the past has been too content to shut himself up in his laboratory, instead of organizing the industries which his own talent can create. The life history of such men as Dr. Nichols, of the General Chemical Company, show what is possible to the chemist in the business field.

Election of Officers

The result of the election of officers was then declared as follows:

Chairman—Dr. W. L. Goodwin, Kingston.

Vice-chairman—S. B. Chadsey, Brantford,

Council—Theo. H. Wardleworth, Dr. Frank T. Shutt, Dr. J. Watson Bain, Prof. E. G. R. Ardagh, Dr. M. L. Hersey, Dr. J. S. Bates, C. R. Hazen, R. Job, W. H. Thom, Dr. W. O. Walker, H. Van der Linde, Prof. W. Lash Miller.

Secretary—Alfred Burton, Imperial Munitions Board, Ottawa.

Officers of local Sections are as follows:

MONTREAL

Prof. N. N. Evans, chairman.

James Walker, sec.-treas.

Committee—W. D. Campbell, I. Grageroff, N. Holland, Dr. J. S. Bates.

TORONTO

Prof. E. G. R. Ardagh, chairman.

A. L. Acton, secretary-treasurer.

Committee—M. L. Davies, D. E. Beynon, D. G. Buchanan, R. W. Perry.

OTTAWA

Dr. Frank T. Shutt, chairman.

Joseph Race, secretary-treasurer.

Committee—Edgar Stansfield, O. J. D. Thomas, M. F. Connor, D. S. Cole, E. L. Westman.

The retiring chairman, Mr. Theo. H. Wardleworth, was nominated for the council of the general society for the ensuing year.

Dr. Frank T. Shutt

Dr. Frank T. Shutt, head of the Laboratories of the Dominion Experimental Farms, was a very busy man during the Convention for he was not only interested in the work of the Society of Chemical Industry, but was chairman of the Section of the Royal Society devoted to mathematics, physics and chemistry, the Royal Society having some of its sessions while the convention of the chemists was in progress. Before the Chemical Convention at Ottawa was contemplated, the energy of Dr. Shutt had already enlisted the interest of a number of chemists and metallurgists, whose papers before the Royal Society will be referred to in another issue. We may look for more of Dr. Shutt's energy to be directed in behalf of the good work now being done by the Society of Chemical Industry.

Comments on the Convention

Mr. Wardleworth proved an ideal chairman. Tactful and tolerant, he kept things moving, and happily the discussions though animated were carried on in good temper.

One striking feature of the convention was the large proportion of young men, who were the keenest listeners and the most modest talkers. At the business sessions two-thirds of the average in attendance were under thirty-five. It is a good omen for the growth of the chemical industry.

The convention was not without recognition in high quarters. First there was the letter of Sir George E. Foster, referred to elsewhere, showing a statesman's grasp of the national problems for the solution of which the country looks to its chemists. Then there were the appreciative remarks of Senator Girroir, who on the orders of the day being called in the Senate, said:

"I wish to call attention to the fact that the Canadian chemists are meeting here to-day in their first annual convention. I regard the work of the Canadian chemist as of the greatest national importance. In the development of our industries and resources the chemist is needed at every step, and if this country is to progress it is necessary that we recognize in the fullest manner the important work which these men have in hand."

On the opening day the Ottawa Citizen gave an editorial welcome to the chemists in an article which showed an intelligent grasp of the situation. Referring to the fact that over $100,000,000 have been invested in the chemical and allied industries of Canada since the war, the writer acknowledged that "No other group of technical or professional men have made such strides in bringing the basic industries of the country into step with the stern necessities of war as have the chemists." The Citizen believes the society acted wisely in expanding the annual meeting into a first Canadian convention.

One of the minor events, which should not pass unmentioned, was the little visit to the new Parliament Buildings, at five o'clock on the first day of the convention. In company with members of the Royal Society and as guests of the authorities, a very pleasant hour was spent going through the new buildings and observing the work under way. The architectural detail was pointed out and the visitors were permitted to look upon those rooms yet to be made famous and historical by future Canadian statesmen. We are entering on the new era of our country's life with new concepts, new aims, with new "tables of stone" and a new house to rest them in.

In spite of the enthusiastic manner in which the movement to form an Association of Canadian Chemists, or its equivalent, was received by all attending the convention, it is just possible that much good advice given at that time may be either lost or forgotten if not recorded here. The avowed aims of any such movement, as far as the average chemist is concerned, circle around his conception of mutual protection and advancement gained through the medium of general co-operation. This problem is vastly more difficult than any presented to other bodies of professional men who may have formed themselves into a successful close corporation. Doctors and lawyers, for example, have existed as necessities in the state since the organization of society, while the industrial chemist is practically a new concept in the public mind. The ground over which the chemist hopes to make his advance must be well prepared. We need university faculties of chemistry as well as faculties of medicine and law. We need a Minister of Science in the Cabinet. Until such time as chemists are able to prove to the government that a general public service would accrue from their being legally recognized it is hopeless for them to advance any personal claims of relative hardship or underpay. Their cause is just and right on these grounds but it behooves them not to get the cart too far ahead of the horse in this connection. Let each man steadily learn to view his work from the angle of the average non-technical business man in the country. It is a simple matter for Canadian chemists to organize themselves and this first step should be taken almost immediately or during the course of the next year. The second step, however, involves factors quite outside of themselves and the only proper motive behind this must be the attainment of a higher plane of national service for chemists. The second step involving legal status may be attained only on these grounds. Provided this matter is taken up in the right way there is hope of reaching the desired end. When this has been done those personal and secondary results naturally follow.

Dr. John Waddell

Taking advantage of the presence at the chemical convention at Ottawa, of Dr. Waddell, of Queen's University, about forty graduates in Engineering who were former students of Dr. Waddell gave a luncheon in his honor. A very happy time was spent, graduates being brought together who though living for years in Ottawa had not met. The chairman was Dr. M. Y. Williams, one of the prominent geologists of the Mines Department. The reunion was inspired by a recollection of the sympathetic interest in the welfare of his students that always characterized the teaching of Dr. Waddell. One favorable reaction from this reunion was the bringing forward of some suggestions for improved work in Queen's University in the future, and no doubt one or more of these suggestions will be carried into effect.

Dr. Waddell was born in Picton, N.S. After studying in Picton Academy and taking the B.A. degree in Dalhousie University, Halifax, he went to Edinburgh University where he was Hope Prizeman and Vans Dunlop scholar. He holds the degree of D.Sc. of Edinburgh and B.Sc. of London, as well as Ph.D. of Heidelberg. In addition to his work as professor in chemistry, he is librarian for the Science Faculty of Queen's. Before coming to Queen's he was for several years professor of science in the Royal Military College of Canada. Dr. Waddell is the author of "The Arithmetic of Chemistry," of "A School Chemistry," and of "Quantitative Analysis in Practice." He has also written a number of scientific papers and educational articles in British and American periodicals, among them two which recently appeared in The Canadian Chemical Journal.

Observations by "The Youth"

Yes, the Youth was there too. He sneaked away from the plant and paid his own expenses. But he was there. He had very little to say. In fact he had practically nothing to say except once or twice and then it was questionable whether he had really spoken or not. When he stood up his youth seemed to fade. But he saw a lot and heard quite a bit too.

He was right there at the Mint and saw them pouring gold like pig iron and visited the Mines Branch with the rest of the mob. He had his picture taken too, with his hat both on and off. In the afternoon he also went over to Hull and saw the girls packing up the matches, etc.

But what pleased him most was the Chateau. Here he could see all his old professors standing around smoking the same old pipes. How natural they all looked and what utterly foolish and commonplace things seemed to interest them now. By

what means had he ever been taught to exalt their vast knowledge and wisdom. Some of them even drank afternoon tea and could find time to watch the officers dance. Others complained of boils and the gout and other evident or hidden signs of divine wrath. Many of them, formerly of great repute, gave vent to the most inane and ridiculous remarks about the new Parliament buildings.

Discussions on salary seemed to interest the youth particularly. Whether it were better to take the boss by the throat and squeeze a few shekels a month out of him or gradually learn how to by answer a few of his letters properly, seemed to be alternative suggested as cure-alls in this connection by those who had evidently passed up the ladder.

Flat rates for meals also enabled him to look the "bell-hops" in the eye as he passed to and fro. A very significant button assisted him in facing the local man-chasers of Ottawa who have a keen eye for new faces—especially young male faces. He very nearly became excited when it was proposed that a committee of chemists get busy with the government, and talk over the matter of his exemption.

He got the night train out of town strongly convinced that if his firm was not able to compete on the South American market after the war or if they did not get duty free alcohol neither he nor the man above would have the wherewithal to buy even the cheapest cigarettes. And before he fell asleep a "vision of the night" made it clear to him that before he and the other contemporary youths could hope to run one of these conventions he would have to get busy on his job.

Notes from New York

New York, June 3rd, 1918.

Correspondence of The Canadian Chemical Journal

By F. M. Turner, jr.

The principal event of the past month was the Southern trip of the American Electrochemical Society. The writer was unable to take the trip for business reasons, but the following account was furnished by one who was fortunate enough to have this opportunity.

The Society met at Washington, D.C., on Sunday, April 28th. The trip was commenced Sunday evening in a special train. It is an indication of the importance attached to the development of chemical industries at the present time that this special train was permitted by Secretary McAdoo. The first point visited was Johnson City, Tenn., where there are a number of important chemical industries. The members were entertained here by the Chamber of Commerce. Kingsport, Tenn., was next visited. At this point, largely due to the efforts of the Carolina, Clinchfield & Ohio R.R. a large number of chemical industries have been established. The following plants were visited: Federal Dyestuff and Chemical Company, Clinchfield Cement Company, Kingsport Extract Company, American Wood Reduction Corporation, Kingsport Pulp Company, and Kingsport Tanning Corporation. At the cement plant a Cottrell process potash precipitation plant is being installed. A dinner and dance were the social features of this part of the trip.

On April 30th, at Mascot, Tenn., the ore concentration plant of the American Zinc Company was inspected. Here a flotation process is in operation.

At Knoxville, Tenn., the great hydro-electric developments of the Aluminum Company of America were the chief points of interest. At this point a water power of 80,000 horse power is being developed. A business and technical meeting was held at the University of Tennessee, the President of which institution delivered an address.

The next day a banquet was held at the Cherokee Country Club after which addresses were given by President Colin G. Fink on "Electrochemistry and National Economy," by Prof. Switzer, of the University of Tennessee, on some hydro-electric developments. This lecture was illustrated by views of water-power sites capable of developing several hundred thousand horse power. The third address was by C. G. Schluederberg on "United States Industries and Winning the War."

At Chatanooga, Tenn., the plant of the Southern Ferro-Alloy Company was inspected. This company is making ferro-silicon. An electrolytic oxygen-hydrogen plant was also inspected. This plant supplies hydrogen which is used for hydrogenating cotton-seed oil by Wilson & Company, of Chicago, who have a plant at this point.

A gas plant and some hydro electric developments were also seen at this point and the day was closed by a dinner at Signal Mountain.

On Thursday, May 2nd, the great government developments at Muscle Shoals were visited.

At this point one is impressed with the importance of the work the Government has undertaken to provide an adequate supply of fixed nitrogen not only for the purposes of the present War but for the future after the War.

Two very large plants are now being constructed and it is not improbable that two more equally as large will be built in the near future.

One of these plants will operate a synthetic ammonia process similar to the Haber process developed in Germany. This process is the property of the General Chemical Company and the rights to use it have been given to the Government for the period of the War. The ammonia will be oxidized to nitric acid in part, and in this way ammonium nitrate will be produced. This plant employs over two thousand men and is costing about $20,000,000.

The second plant is under the control of the United States Ordnance Corps and is being built by the Air Nitrates Corporation. The Air Nitrares Corporation is very closely connected with the American Cyanamide Company, who operate a large plant at Niagara Falls, Ont. Over twelve thousand men are employed at this plant and a model village is being constructed to house them. Hospitals, moving-picture theatres and other facilities for comfort and recreation are provided. This plant will use 350,000 tons of lime per year and will produce 200,000 pounds of nitric acid per day.

From Muscle Shoals the party went to Birmingham, Ala., where the blast furnaces and steel plants of the Tennessee Coal, Iron and Railroad Company were inspected. A visit was also paid to the works of the American Steel & Wire Company. A dinner and a technical meeting were also held at this point.

Anniston, Ala., was next visited where the plant of the Southern Manganese Corporation was the chief point of interest. At this plant ferro manganese is produced in electric furnaces.

From Anniston the party returned direct to Washington, D.C., in a special train.

This trip was most valuable in bringing before a large number of the foremost chemical and electrochemical engineers of the country, the enormous possibilities of the resources of the South. The extent to which these resources have already been developed was a good deal of a surprise to many of those participating in the trip. It was, however, obvious at every point that what has already been done in this connection is only a small fraction of what can be expected from this region in the future. With its enormous resources of minerals of every kind, its enormous forests from which wood chemicals can be produced and its immense water powers, the Southeastern section of the United States ought to become one of the greatest manufacturing districts in the world in the very near future.

On May 11th the Textile Exposition held at the Grand Central Place, New York City, closed. This Exposition, the first of its kind, was a great success. It occupied the entire four floors of the Palace. The main floor was devoted to textile machinery. The second floor was devoted to textile machinery and various

accessories used in textile mills. On the third floor the exhibits of the producers of dyestuffs and textile chemicals were found. On the fourth floor were to be seen the textiles themselves.

The National Aniline & Chemical Company and Marden, Orth & Hastings Corporation had particularly good exhibits comparing American dyes with those formerly obtained from Germany. Comparative tests were made daily by the staff of these concerns showing comparisons between the domestic and foreign products. In this way it was demonstrated to the thousands of visitors to this Exposition that the United States is now producing dyes in great variety, which are in every way the equal, if not the superior of the foreign article.

A very disastrous explosion wrecked a large part of the plant of the Aetna Explosives Company at Oakdale, near Pittsburgh, Pa. The explosion occurred in a part of the plant in which trinitrotoluol was stored. Federal officials have investigated the explosion but have as yet issued no statement as to the cause. Over fifty men were killed and over ninety injured, while a considerable number are still missing. The damage has been estimated at over $2,000,000.

F. M. TURNER, Jr.

Recent Canadian Patents

Of Interest to the Chemical and Metallurgical Industries

182,101. A method of making Indoxyl and its derivatives by fusing a phenyl-glycine body with a caustic alkaline substance and passing the resultant body into water, out of contact with air. The Dow Chemical Company, Midland, Michigan.

182,110. A process of forming Urea by reaction upon a metallic cyanate, in the presence of water, with an ammonium acid salt, then treating with ammonia and an anhydrous reagent to separate precipitate from the urea. The Nitrogen Products Company, Providence, R.I.

182,133. A process for obtaining Spelter by combining finely divided zinc bearing material containing zinc in metallic form with a reducing and binding agent, and subjecting the resulting briquets to heat in order to convert the metallic zinc in same into vapour, the vapour being then condensed into spelter. David Benton Jones, Chicago, Ill.

182,236. A process for melting iron and Steel by spraying liquid hydro-carbon without admixture of steam into a gas producing chamber, mixing with preheated air, and burning on the hearth of a furnace. Frederick G. C. Rinker, Holland.

182,269. A flat finish paint composition comprising a lead pigment and a vehicle in which tung and semi-drying oils are used in varying proportions. Walter Erwin Wright, Cleveland, Ohio.

182,307. Reclaiming oils by treating with a suitable inert absorbent substance, distilling the naphtha constituents therefrom, and flowing the mixture into association with a retarding filtration agency. The Swan Process Company, Denver, Col.

182,360. The method of producing Carbon Monoxide from carbon dioxide by mixing with powdered carbon and heating the mixture to a reducing temperature. Charles B. Hillhouse, New York.

182,387. A method of treating ligno-cellulose materials by heating under pressure in a closed vessel with a dilute hydrolizing agent, afterwards reducing the temperature by vacuum. By this means cellulose materials may be converted into fermentable sugars. Geo. H. Tomlinson, Niagara Falls, Ont.

182,389. The process of making vegetable glue from starch compounds by treating the hydrolized starch with an aluminate. Raymond W. Tunnell, Philadelphia, Pa.

Lapsed Patents

Reported by Hanbury A. Budden, 712 Drummond Building, Montreal, Que.

No. 139,454. Ore obtaining process. Korda, France. Treating zinc ores mixed with coke in a converter lined with coke.

No. 139,455. Art of separating suspended articles from gaseous bodies. Zenneck, Germany. Passing gases first through brush discharge and then through electric field without brush discharge.

No. 139,621. Rosin manufacture. Sommer, Russia. Pulverizing resin, emulsifying with water mixing with dilute alkaline solution and adding sulphate of alumina.

No. 139,747-8. Machine for and process of briquetting and pressing materials. Ronay, Germany. Increasing pressure as air content decreases.

No. 139,792. Method of Liquefying Gases. Heylandt, Germany. Compressing gas at moderate pressure, cooling to liquefying pumping to high pressure, heating to gasify and expanding to cool gas under moderate pressure.

No. 139,805. Ore reduction. Leslie, Scotland. Improvement in cyanide process. Drawing off gases given off in treatment and forcing them back under pressure.

No. 139,806. Cement manufacture. Lessing, Germany. Atomizing molten blast furnace slag, burning a portion with lime and mixing with unburnt portion.

No. 139,831. Metal reduction. Wehrlin, Germany. Treatment of arsenic bearing anode mud. Converting arsenic into volatile compound and distilling below 212°F.

No. 139,838. Glass plate. Simon, Germany. Spreading liquid glass on inclined surface, stretching pressing, heating, stretching cutting into plates and annealing.

No. 139,927. Heat insulating material. Ferra, France. A compound of copper sulphide sulphur and kaolin or the like.

No. 139,936. Device for measuring vapour gases, etc. Hartung, Germany. Apparatus employing valves and electrical resistance.

No. 139,938. Method of decomposing mixture of gases. Heylandt, Germany. Passing cooled mixture in bubbles through liquid gas.

No. 139,950. Device for the continuous annealing of metals. Kugel, Germany. Series of preheating annealing and cooling retorts with gas tight closures.

No. 139,988. Steam engine. Stumpf, Germany. Uniflow engine.

No. 139,996. Gas producer. Von Kerpely, Germany. A grate mounted on shaft, a rotable ash pan and means for discharging ashes.

Industrial News

The first unit of a plant for making toluol by a new process is now being installed at the works of Hiram Walker & Sons, Limited, distillers, Walkerville, Ont., and if the success of the process is demonstrated other units will probably be added.

The Rainy River Pulp and Paper Company announce the appointment of Mr. B. F. Taylor as general manager. Mr. Soderberg will be in charge of this company's mill at Port Mellon, B.C.

Niagara Falls Evening Review states that five acres of land east of the Niagara Smelting Company's plant have been bought by the United States Government as a site for the new million-dollar electrolytic alkali plant. The contract for the erection of the plant has been let to J. G. White Engineering Company, of New York.

Magnesium sulphate is now being produced for the first time in Canada. The Stewart Calvert Company, of Oroville, Wash., are working deposits at Spotted Lake, B.C., about six miles from the United States border. The material is being shipped chiefly for use in the United States market.

The Sunbeam Chemical Company is a new business organized with a capital of $50,000. It is the Canadian branch of a Chicago house manufacturing household package dyes and laundry chemicals. Mr. F. J. Garvin is manager of the Chicago house and Miss F. Lewis is in charge of the Canadian branch with office at 79 Adelaide Street East, Toronto.

Nitrate Recovery from Water Gas*

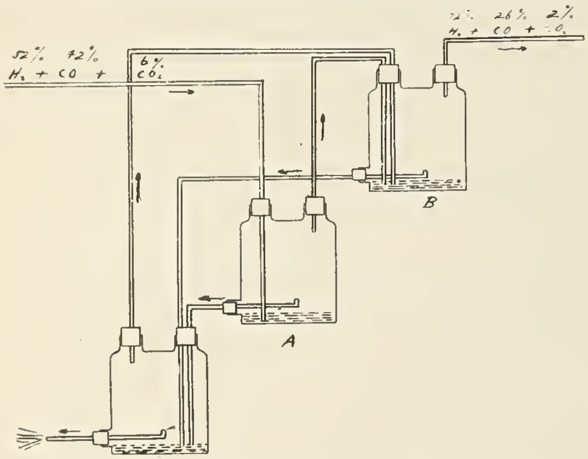
By J. Stephenson, Hamilton, Ont.

It is with deep interest that I read the article, "Nitrogen and its Compounds," by Horace Freeman, and would like to contribute a few observations I have made regarding the possibilities of nitrate recovery by the decomposition of air and water for the production of nitrogen and hydrogen. The base of the "Haber Process" as we have learned from Mr. Freeman's article, is to combine nitrogen and hydrogen by the influence of a catalyst under a high compression, and from the successes that Germany has made in the manufacture of explosives, it is apparent that this process is one of the most practicable.

Assuming that nitrogen and hydrogen can be synthetically combined as in the aforesaid process to form NH_3, it remains for us to produce these two gases in the most economical way, and in view of the fact that we have not advantages of cheap electrical power as offered by the Norwegian Cascades, it behoves us to look in another direction.

Water Gas Reaction

As a gas and fuel engineer, I would say that nitrogen and hydrogen are produced on a gigantic scale from air and water in the internal combustion or water-gas process of manufacture. It may be said that water gas is a mixture of hydrogen and



carbon monoxide, and is produced by passing steam through incandescent carbon containing matter when the reaction $C+H_2O=CO+H..$ takes place. The steam cools the fuel and after a run of four or five minutes, the revivication takes place, in which the steam is cut off and air passed through for a few minutes. The oxygen of the air is consumed to carbon dioxide and passed to the atmosphere mechanically mixed with the nitrogen. An average analysis of water gas made from coke for a period of thirty days, gave a composition of 52.37% hydrogen, 41.78% carbon monoxide, 5.00% CO_2, and traces of other impurities. The average yield per pound of fuel is 35 cubic feet of gas, and the volume of hydrogen obtainable per pound is therefore $\frac{52.37\times35}{100}=18.33$ cubic feet. The volume of air consumed in the revivication period is approximately 1.5 cubic foot per cubic foot of water gas, of which the oxygen is consumed in the combustion of carbon to CO_2. As the atmosphere consists of approximately 80% nitrogen and 20% oxygen, the air-blast gases consist of N and CO_2 in proportions of 4 to 1 respectively. The volume of nitrogen is therefore $1.5\times.80=1.2$ per cubic foot of water gas, and is greatly in excess of that required for combination with hydrogen for the formation of NH_3. If the weight of hydrogen is taken as 39.1 grains per cubic foot, the amount per pound of fuel is $18.33\times39.1=717.5$ grains, or 205 pounds per ton. The volume of nitrogen with which 18.33 cubic feet of hydrogen will combine is 6.11 cubic feet, the weight of which is $548.9\times6.11=3{,}354.8$ grains, or 958 pounds per ton of fuel. It is obvious from the above that 2,000 pounds of carbon fuel can be made to yield 205 pounds H and 958 pounds N, or the desirable elements for the formation of 1,163 pounds of NH_2.

Purification

The cost of producing N and H in a crude state by the water gas process is comparatively small both in fuel and capital outlay, and the most difficult proposition is to separate the hydrogen from the carbon monoxide, and nitrogen from the carbon dioxide in the air-blast gases. The weight of carbon monoxide is 13.89 times heavier than hydrogen, which affords the opportunity of separating these gases by their gravities, and it may be interesting to note a simple experiment I have made with this purpose. I arranged a set of three wide-mouthed flasks, A, B, C, and conducted a stream of water gas of the aforesaid composition into flask A at a pressure of six-tenths inches of water. The inlet tube is sealed in five-tenths inches of water to momentarily resist the flow and allow the hydrogen to ascend to the top of the flask, and CO to pass off from the bottom. The hydrogen was collected from flask B for analysis, and carbon monoxide from C ignited. The subsequent analysis showed an increase of 20% hydrogen from the original composition, and would no doubt be increased further by extending the separating system. In a practical scheme laid out on this principle, it would seem possible to obtain hydrogen 95% pure, after which the purification could be made by absorbents. The nitrogen and carbon dioxide are most economically separated by passing the gases through lime water for absorbing CO_2.

*The writer is superintendent of the United Gas and Fuel Co. of Hamilton. He is the author of "Elements of Water Gas," published in 1916, and is also the inventor of several improvements in gas generating apparatus. A new edition of "Elements of Water Gas" is now in preparation.

Oil Discovery in Northern Ontario

A mineral discovery of great importance to Canada under present circumstances was made last month in the Sudbury district. Near the point where the C.P.R. crosses the Wahnapitae river an earthquake occurred two years ago which had the effect of bringing up from a spring on Hassad's farm an oily discharge having the smell of petroleum. An oily discharge had been noticed before, but the earthquake and the breaking up of the ice in the river increased the discharge so that it was examined by a member of the firm of Demorest and Stull, mining engineers, of Sudbury, and found to be petroleum. The location is on the boundary of Street and Scadding townships, about seventy miles north-west of North Bay, in a region where surface rocks had not indicated petroleum. Many claims have been staked and drilling is now going on. If this proves to be a large oil field it will be of great value to a number of chemical industries.

A new well with an initial flow of over 200 barrels a day has also been struck in Dover township near Chatham. The Union Gas Company is operating the well, which opened with an unusually strong gas pressure.

British America Nickel Corporation

After some extended negotiations between the Ontario Government and the British America Nickel Corporation an agreement has been reached by which the nickel refinery of the company will be erected at Deschenes near Hull, Que. Already a large number of workmen have been engaged by the contractors for the buildings, the Bate-McMahon Company, for laying out the site and for excavating. The main buildings will be near the Hull Electric Company's car sheds, and the power plant will be near the rapids. The buildings and equipment will cost about a million dollars. In consequence of these developments the head offices of the company have been moved from Toronto to Ottawa. It is expected that the company will be able to treat the ore from its Sudbury mines at the new works within the year.

Personal

Mr. W. F. Geddes, of the Ontario Agricultural College, Guelph, Ont., has accepted a position with the British Chemical Company, Limited, of Trenton.

Mr. S. B. Chadsey, chairman of the Toronto Section of the Society of Chemical Industry, and assistant to the general manager of the Massey-Harris Company, has been appointed manager of the Massey-Harris Company's plant at Brantford.

Mr. G. Hallberg, formerly with the Riordon Pulp and Paper Company, Limited, Hawkesbury, has been appointed chemist at the Mattagami Pulp and Paper Company's sulphite mills at Smooth Rock Falls, Ont.

Mr. A. Gordon Spencer, consulting chemist and metallurgist, 619 Transportation Building, Montreal, Que., is giving up his consulting practice to devote all his time to the munition and other work of the Peter Lyall & Sons Construction Company, Montreal, as their consulting metallurgist.

Prof. N. B. Porter, of McGill, and Prof. Thompson, of Toronto University, have been in St. John, N.B., in connection with a campaign to gather and prepare sphaguum moss for Red Cross dressings. There are large beds near St. John.

Dr. H. L. Abramson, for the past five years assistant health officer in New York, has been appointed chief of the public health laboratories for New Brunswick, with headquarters at St. John.

Ernest R. Westman, son of Mr. Thos. Westman, of the Department of Inland Revenue, Ottawa, has won the Second Alexander Fulton Scholarship at Toronto University, he having obtained the highest average for laboratory work during the year among the students of the four federated colleges—University College, Victoria, Trinity and St. Michael's—taking the honor course in chemistry at the University.

Mr. K. F. Mather, who has been assistant professor of geology at Queen's University, for several years, has resigned to accept the geology professorship in the Dennison University, Grenville, Ohio.

Dr. J. Bishop Tingle, professor of chemistry at McMaster University, has been elected a fellow of the Royal Society of Canada.

Dr. R. F. Ruttan, director of the Department of Chemistry of McGill University, and chairman of the chemical committee of the Honorary Advisory Council for Scientific and Industrial Research, was elected vice-president of the Royal Society of Canada at its meeting in Ottawa last month. Dr. Ruttan is also vice-president this year of the Society of Chemical Industry of Great Britain.

Mr. A. Douglas Macallum, research chemist, Toronto, has been granted exemption from military service on the ground of being engaged in the manufacture of diarsenol as a serum in the treatment of syphilis. Before the war this product was controlled by Germany under the name of salvarsan, but the Canadian product is reported to be equal to the German, and now sells at a higher price than that produced in the United States. The diarsenol as produced in Canada is the discovery of Mr. E. N. Macallum, a graduate in chemistry and physics at the University of Toronto. It is now being manufactured by the Synthetic Drug Company, Toronto.

Walter A. Lawrance, B.A. (McMaster) has completed a research on "Some nitration products of Picranilid and Diphenylamine." The compounds produced and investigated are tetranitro-diphenylamines. Some of their properties are described for the first time. This paper which was read before the Royal Society in Ottawa last month, has been accepted by McMaster University for the M.A. degree. Mr. Lawrance is now research chemist for the Toronto Carpet Manufacturing Company, Limited, and the Barrymore Cloth Company, Limited. Previous to entering this service he was on the staff of The Canadian Chemical Journal.

Canadian Electro Products Company

Editor Canadian Chemical Journal:

Sir,—In the May issue of your Journal, page 131, there were errors by your Montreal correspondent regarding my connection with the Canadian Electro Products Company, Limited, Shawinigan Falls, Que. I wish you would make correction by inserting this note in your next issue.

My duties at the Shawinigan plant have been as representative of the Imperial Munitions Board, Mr. H. W. Matheson being general manager and chief chemist of the Canadian Electro Products Company, Limited. I have not given up my position as superintendent of the Forest Products Laboratories of Canada.

JOHN S. BATES.

700 University St., Montreal.

Wood Flour

In reply to a number of subscribers who have recently asked for information on the uses and methods of manufacture of wood flour, we give the following account by Mr. Frederick W. Kressmann, chemist at the Forest Products Laboratory, Madison, Wisconsin:

Wood flour is ground or milled wood that has been screened so as to remove coarse particles and also to give particles having some uniformity in size. Wood flour is usually sold as 40, 60 or 80 mesh—that is, screened in bronze wire having 40, 60 or 80 meshes per inch—although one large foreign purchaser has the following specification for dynamite flour:

20% must pass through an 80-mesh screen.
50% must pass through a 60-mesh screen.
100% must pass through a 50-mesh screen.

The different properties of a good wood flour are:

First—it must be white.
Second—it must be light and fluffy.
Third—it must be absorptive.

All industries in which wood flour has so far been used require a white or very light cream colored flour, although absorptive qualities are demanded in a large degree only in dynamite flours. Color and weight considerations, therefore, limit the species of wood which may be used to the white, light non-resinous conifers and to the white broad-leaved woods like aspen and poplar. Spruce, white pine and poplar are the species most often used. The wood must be barked before grinding, and round wood, slabs (barked) and sawdust free from bark may be used.

The grinding of the wood is performed in two distinct types of apparatus—either stone mills or steel burr roller mills. In Europe, particularly Scandinavia, where a great deal of wood flour is made, the stone mills seem to be used exclusively and most of the early plants in this country use this type of mill. The stones are from 40 to 60 inches in diameter and only the lower stone is driven, the upper one being stationary. The mills are driven with water power turbines, since flour produced with other sources of power cannot compete with Norwegian flour ground by water power.

The wood after barking is first reduced to chips by means of the usual type of chipper or hog. These chips, along with a certain proportion of the screenings are fed to the mills which are completely inclosed (with the exception of an opening at the top) with an iron or steel cover. Sufficient steam or water is added to prevent firing and also to keep down the dust. The fine stuff from the mill is then drawn or blown through iron pipes or sheet metal ducts to the screening apparatus, which may be of several types, and which may be either bronze wire or silk bolting cloth, for both are used. After screening the flour is packed either in compressed bales (the imported material comes in this way) or else is sacked with automatic sacking and weighing machinery. Mills of this type require from 45 to 50 horse power per twenty-four hours per ton (from 1,200 to as high as

1,500 horse power hour per ton) of flour produced, the power requirement being about the same as in the production of mechanical ground wood pulp.

Another type of mill was developed on the Pacific Coast about twenty-five years ago and was designed especially to handle sawdust as a raw material. This grinder consists of a number of pairs of corrugated chilled steel rolls which turn toward each other. One of the rolls rotates three times as fast as the other, thereby actually cutting the sawdust which comes between them. The slower roll has its corrugations arranged so that they form pockets to hold the dust while the faster roll does the cutting. There are three stands or rolls, the corrugations being progressively finer on each stand. The sawdust is screened before reaching the first rolls so as to remove slivers, small blocks, etc. It is then passed over a strong electric magnet to pick out any particles of iron or steel present and is also screened through bolting cloth betwen each pair of rolls to remove material of suitable fineness. The production of wood flour from sawdust in this type of mill requires only from 20 to 25% of the power required with the stone mills.

Before the war Norwegian flour was delivered at United States Atlantic ports for from $12.50 to $15.00 per ton and domestic material sold in competition therewith. The domestic production is largely controlled by one concern, although mills are scattered all over the country from Maine to California wherever the combination of proper wood and water power is available.

The principal uses for wood flour are in the manufacture of dynamite, linoleum, artificial plastics and flooring, and as an inert absorbent in many industries.

Dynamite, being nitroglycerine absorbed in some porous material, wood flour, wheat flour mill refuse, and infusorial earth (kieselguhr) are the principal materials used and wood flour is the one commonly used to-day as an absorbent. In addition, a certain amount of oxidizing material, either sodium or potassium nitrate with traces of calcium carbonate, magnesium carbonate, or zinc oxide are used. The latter materials are added to neutralize any free acid that may be formed by the decomposition of the nitroglycerine in long storage.

The composition of typical dynamites is as follows:

Moisture	..	1.4
Nitroglycerine	40	60.6
Sodium or potassium nitrate	44	18.6
Wood flour	15	18.2
Calcium carbonate	1	1.2

A dynamite flour must be both white and highly absorptive. Since dynamite darkens with age a light-colored stick is indicative of fresh stock and trade demands, therefore, require the use of a white flour. For this reason it would be practically impossible to introduce the use of a wood flour produced from any colored woods. A good flour should be capable of making a 60 or 70% dynamite (60 or 70% of the total weight being nitroglycerine) without permitting leakage or exudation of nitroglycerine. It is possible to improve the absorptive qualities and power of a flour by mixing it with water, boiling it actively for a short time and then drying, although this process, of course, increases the cost of production appreciably. For dynamite purposes, therefore, wood flour must be as white as possible, it must be absorptive and must be of the proper weight, not only because the size of stick and number of sticks per box is standard, but also because too much flour cannot be used since it would disturb the carbon and oxygen balance in the explosive.

In 1900 over 85,846,000 pounds of dynamite were produced in the United States, containing over 9,934,000 pounds of wood flour. In 1909 the production of dynamite increased to about 195,156,000 pounds, and it has immensely increased since the war.

In the manufacture of linoleum, wood flour is used exclusively in the production of goods belonging to the inlaid class, either "granulated inlaid" or "straightline." Cork linoleum is always dark, either the natural brown, or dark red or green. Patterns are printed on cork linoleum, but the pattern soon wears off, leaving the dark base. For the production of inlaid goods in which the pattern goes clear through the piece to the burlap backing a white base is naturally necessary, not only to furnish a white background where desired, but also to permit of dyeing to any color. For this reason a flour as white as possible is desirable.

Linoleum consists of wood flour or cork flour mixed with a cementing material which is spread out on burlap and rolled or pressed hydraulically thereon. The cement consists of oxidized linseed oil melted with rosin and Kauri gum. The cement is the expensive constituent, it being worth from $125 to $175 per ton, depending on the price of linseed oil. Naturally the lightest flour will produce the largest volume of goods, since the raw materials of linoleum are purchased on a weight basis and sold on a volume basis. The weight per cubic foot is, therefore, along with the color, of prime consideration to the linoleum manufacturer.

The following table shows the comparative weights per cubic foot of cork and wood flours of different sizes:

28-mesh cork	6.25 lb. per cu. ft.
56-mesh cork	7.50 " "
80-mesh wood, imported	13.00 " "
40-mesh wood, domestic	9.00 " "

Another manufacturer reports as follows:

26-mesh cork	4 to 4.5 lb. per cu. ft.
60 to 80-mesh wood, imported	4. 8 lb. per cu. ft.
60 to 80-mesh wood, domestic	6.8 " "

The difference in the above figures is due chiefly to the method of measuring and the amount of tamping in the measure, but in either case the wood flour weighs about 50% to 100% more than the cork. Cork waste before the war was worth about $35 per ton and it costs about $5 per ton to grind it with power at 1½ cents per kilowatt. Practically all cork flour is ground here either from domestic waste or waste from Spanish cork mills. Cork flour is, therefore, worth about three times as much as wood flour, but since they both require equal amounts by weight of cement and since the latter is the expensive item and also because the volume of goods produced from cork is so much greater than that from wood, the cork linoleum is cheaper for goods of equal thickness than wood flour linoleum. Cork linoleum is also cheaper to manufacture than wood linoleum because it is simply rolled between calender rolls, whereas the production of inlaid linoleum requires a considerable amount of hand work in the production of granulated inlaid and also a tremendous expense for dies in the production of "straight line." The seasoning time for cork is also less than wood flour linoleum of equal thickness. Cork linoleum is slightly more elastic than wood flour linoleum, although wearing qualities are about the same. Here also the importance of a white flour with a low weight per cubic foot (fluffiness) is noted.

In 1909 about 4,460,000 square yards of different kinds and thicknesses of inlaid linoleum were produced in the United States. No statistics are available in which this production is classified into different thicknesses and grades. In general, however, the grades most commonly used will weigh from 8 to 12 pounds per square yard (exclusive of the weight of the paint backing) and will contain from 40 to 50% of wood flour.

There are various other uses of wood flour, such as flooring, plastics, oatmeal paper, etc., and for most of these uses light color is also required. In some cases certain species of wood are necessary, as in the production of artificial bates for tanneries. For the last named purpose there is required a mixture of wood flour, ammonium chloride and certain animal extracts which are absorbed by the wood flour. Here again the trade demands a light colored product and it has been found that flour from broad-leaved woods like poplar will cause a discoloration on storage so that only flour from spruce or white pine may be used.

War Strain and the Labor Problem

Many employers of labor are finding that returned soldiers are proving unsatisfactory on account of the terrible nervous strain they have been under. The manager of one factory, who is evidently endowed with good sense and kindly feeling, has solved the problem.

One returned man, after a few hours of work in the factory, told the manager he could not stand the noise of the machinery. He was urged to stick to his job, but to take an hour or two off whenever he felt like it for the first couple of weeks. As a result, the man gained confidence and overcame his nervousness, and is now a full time, first class operator.

A Mineral Substitute for Soap

According to a French patent, issued to G. Petroff, a neutral detergent substance can be obtained by treating a hydro-alcoholic solution of sulphonic acids, obtained in the purification of mineral oils by sulphuric acid, with a solution of caustic potash, of caustic soda or of carbonate of ammonia. A non-oleaginous solution of alkaline sulphonates is obtained; the solvent is separated by distillation. This product can be used in place of soap for domestic purposes.—Les Matieres Grasses.

Export of Platinum from Canada

The following regulations to be observed when submitting applications for the export of platinum from Canada to the United States have been issued by the War Trade Board of Canada:

Applications for export license from Canada must be accompanied by: 1. United States import license. 2. Application for United States export license for equivalent quantity from the United States. 3. Undertaking by Canadian importer to produce evidence within sixty days from the granting of Canadian export license to the War Trade Board, Ottawa, that an equivalent quantity of platinum has actually been imported.

American Institute of Electrical Engineers

The result of the elections for the officers of the Toronto Section of the American Institute of Electrical Engineers has been declared as follows:

Chairman—Arthur J. Hull (Hydro Electric Power Commission).

Secretary—Ernest V. Pannell (British Aluminium Company, Limited).

Executive—Ashton E. Cooper (Canadian General Electric Company, Limited); Frank R. Ewart (Ewart & Jacob); William G. Gordon (Halm, Gordon & Company); W. Percy Dobson (Hydro Electric Power Commission); William Volkman (Toronto Power Company); Herbert B. Dwight (Canadian Westinghouse Company, Limited); Gordon R. Langley (Canadian General Electric Company, Limited), Hamilton.

Refractory Materials in Canada*

By N. B. Davis, Geologist, Kingston, Ont.

The most important accessory to the practice of metallurgy and ceramics is a suitable refractory material—a substance that will withstand high temperatures and the accompanying physical and chemical conditions of abrasion and corrosion.

Blast furnaces, melting furnaces of every description, converters, etc., (the tools of the metallurgist), kilns used in the lime, cement, glass, and clay industries, (the tools of the ceramist) all require to be lined with a refractory material, either acid, basic, or neutral in character, depending on the nature of the work.

In Canada the great majority of the industries using refractories are dependent on American and European importations, a condition that has been a natural outcome of the transplanting of industries, of a small population and of a long frontier. There has also been a lack of knowledge of refractory raw materials in the older parts of the Dominion. It has been but recently, under the stress of war conditions, that our industries using refractories have begun to appreciate the necessity of utilizing Canadian raw materials for the manufacture of the finished article into which they enter.

The fuel supply is a very important item in the manufacture of refractories, since high temperatures must be used in burning the ware. Ontario, the principal manufacturing province, has not a local supply of coal, and hence imports both fuel and refractories, largely from Pennsylvania.

Quebec imports all its coal supply from Pennsylvania and Nova Scotia. Refractories are drawn from Pennsylvania and Scotland. There is a small local production of special shapes manufactured from imported American clays.

The Maritime Provinces draw coal from Nova Scotia fields and refractories mainly from Scotland. The Nova Scotia Steel & Coal Company has recently installed a firebrick plant at Sydney Mines and started the manufacture of fireclay shapes for use in ladle linings, generative chambers, flues, etc.

The industries in the Middle West—Manitoba, Saskatchewan, and Alberta—draw coal from the United States and the Alberta fields. Refractories are largely imported from St. Louis district and from Pennsylvania. In the Province of Saskatchewan there is one plant in operation making firebrick at Claybank, about twenty-five miles south of Moosejaw.

The Pacific coast industries use local coal and import some refractory materials from the United States and Scotland. The most extensive plant manufacturing refractory goods in Canada is located at Clayburn, British Columbia. It includes the manufacture of retorts in addition to standard firebrick and special shapes for furnaces.

The manufacture of refractory ware in Canada is therefore limited to a small plant at Sydney, Nova Scotia, one at Montreal, and one at St. John, Quebec, one fair sized plant at Claybank, Saskatchewan, and a larger plant at Clayburn, British Columbia.

Distribution of Neutral Refractories—Clays and Shales

MARITIME PROVINCES.—The clay and shale beds associated with the coal seams in Nova Scotia are for the most part easily fusible materials, which cannot be classed even as semi-refractory.

The only materials, so far found in the coal districts, which approach the requirements for refractoriness, consist of a 3-foot bed of plastic clay overlying the 13-foot seam at Inverness and a 4-foot bed of hard shale underlying the No. 3 coal seam at the mine of the Intercolonial Coal Company at Westville. These have a refractory value up to 2600°F.

The most refractory clay known in Nova Scotia does not occur in the coal measures, but is found in unconsolidated Cretaceous clays at Shubenacadie, on the line of the Intercolonial Railway. Tests on this material show it to be a number 2 refractory, deforming at cone 30 (3100 degrees F.). The white or grey clay at Middle Musquodoboit, sixteen miles east of Shubenacadie, is of similar age and character.

A felsite rock occurring at Coxheath near Sydney has refractory qualities but is non-plastic. When crushed and bonded with plastic fireclay it can be manufactured into a very desirable firebrick.

The most refractory clay so far found in New Brunswick occurs under the thin coal seam at Flower Cove, in the Grand Lake coal area. It is only semi-refractory, as it deforms at the softening point of cone 25 (2966 degrees F.)

QUEBEC.—The only important source of refractory clay in Quebec is confined at present to the kaolin deposit at St. Remi, d'Amherst, situated seventy miles northwest of Montreal. Preliminary experiments with the crude kaolin for the manufacture of fire brick have given promising results and the material is

*Published by permission of the Director of the Mines Branch, Can. Dept. of Mines.

now being tested on a commercial scale. A large quantity of this material is being revealed in the development work at the mine and it is probable that intensive prospecting of the adjacent ground will result in the finding of other bodies of kaolin.

An occurrence of residual clay is reported in Two Mountains county, near the line of the Canadian Northern Railway. This material has refractory qualities, but the deposit is considered too small to be of economic value.

Ontario.—Fireclay is of rare occurrence in the Province of Ontario, and none is found in the more settled portions. There is a heavy annual importation of refractory goods to supply the needs of the large and varied industries. A preliminary survey of the province has resulted in finding only two localities in which fireclay occurs; one being at the Helen iron mine in Michipicoten, where a diabase dike has weathered into a residual clay. This material softens at about cone 26 (2950 degrees F.) The other deposit occurs on the Missanaibi river about forty miles north of the crossing of the National Transcontinental railway. It appears to be extensive, but owing to the remoteness cannot be said to be of commercial importance at present. The search for refractory materials in Northern Ontario has never been seriously undertaken but the prospects of finding new deposits are good.

Manitoba.—No good refractory clays are reported from Manitoba, but some prospecting for this purpose remains to be done, particularly in the Dakota horizon of the Cretaceous. The Odanah horizon of the Cretaceous outcropping at Turtle Mountain, La Riviere, and in the Assiniboine valley near Virden, consists of a hard grey shale that may be regarded as semi-refractory. It withstands temperatures up to cone 15 (2600 degrees F.) before deforming. Like the semi-refractory shale used at Sydney, N.S., it may have a local value as a refractory for medium temperature work. This shale is known as far west as Tantallon in the Qu'Appelle valley.

Saskatchewan.—The southern part of the Province of Saskatchewan is particularly rich in refractory and semi-refractory clays. For a number of years a drypress face brick plant has been in operation at Claybank in the Dirt Hills south of Moosejaw. The material used is a high-grade (No. 2) fireclay and although the most of the brick manufactured in the past has been sold as face brick, a certain amount has been used as firebrick. During the past year the company has been reorganized and it is proposed to manufacture standard firebrick and special shapes as well as the regular line of face brick.

Similar clays to those used at Claybank occur at the north end of Lake-of-the-Rivers, near Mitchellton, on the Canadian Northern; also along the Canadian Pacific, Sterling branch at Willows; south of Twelve Mile lake; and along the Frenchman river valley in the Cypress Hills from Eastend to Palisade. The clays of the Lake-of-the-Rivers valley, Wood Mountain and Dirt Hills, are more refractory than the clays further west. The former deform around 3150 degrees F. while the latter seldom remain intact above 2900 degrees F. The clays of the Cypress Hills are more suitable for the manufacture of vitrified clay ware, such as sewerpipe and stoneware.

Alberta.—No fireclays have been found among the clay and shale deposits of southern Alberta up to the present. Beds of high-grade clays occur in northern Alberta along the Athabasca river for some distance north of McMurray. Most of these clays are of the stoneware type and semi-refractory, but one bed was found to meet the requirements of a fireclay. These clays are apparently in the Dakota formation at the base of the Cretaceous, and intimately associated with the tar sands, in fact some of them are rendered almost useless by the impregnation of finely divided carbonaceous matter.

British Columbia.—The most important sources of refractory clays at present known in British Columbia are the Tertiary beds in Sumas Mountain, where about 15 feet of hard fireclay is interbedded with other shales of a semi-refractory character, together with some useful vitrifying shales. This section on the whole contains the best series of materials known in Canada for the manufacture of a varied range of clay products.

Refractory shales with similar associations to those at Sumas Mountain occur at Blue Mountain, near Whonnock on the Canadian Pacific Railway. Fireclay of residual origin occurring at Kyuquot is shipped to Victoria for the manufacture of stove linings and sewerpipe.

Several samples of so-called kaolin have been forwarded from British Columbia to the Mines Branch for examination, but all of these have proved on testing to be either diatomaceous earth or volcanic ash. It is quite probable, however, that kaolin deposits of commercial value will be discovered in the Interior Plateau region.

Chromite

Of the neutral refractories, chrome brick are of the greatest importance in the metallurgy of iron, copper, antimony and tin. In the manufacture of these bricks, chromite, a sesqui-oxide of chromium (FeO, Cr_2O_3) usually termed chrome ore is used. It is extremely refractory and practically neutral, which properties give it its value. The natural chrome ore is mixed with a suitable binder, when necessary, such as fireclay or a mixture of low calcined MgO and $MgCl_2$, and manufactured into brick. The chief use of chromite brick is as a buffer or separating course or lining between a basic bottom or hearth and acid or neutral wall and crown in order to prevent any reaction at high temperatures between the basic and acid materials.

The Province of Quebec, as in the case of magnesite, has become a large shipper of chromite, the production being 14,397 tons in 1915. Most of the production comes from the Black Lake area, where it occurs as irregular masses and disseminated grains in serpentine rocks.

For refractory purposes chromite ore is sold on the market on the basis of a minimum of 25% Cr_2O_3. The material is hand cobbed and also wet concentrated for the market.

Chromite is known to occur at Tulameen and on Scottie creek in the Clinton Mining Division, and on Taylor creek in the Lillooet Mining Division, British Columbia.

The geological associations of the chromite and magnesite in these areas are upturned Cretaceous sediments, intruded by peridotite, being similar to the occurrence of the same minerals in California.

Bone Ash

Bone ash is a less prominent neutral refractory but has its use in the metallurgy of lead and for assaying.

The amount of bone ash used in Canada for this purpose is limited and the market for a substitute is small. Experiments are projected to ascertain the value of the mineral apatite as a substitute.

Acid Refractories

Two kinds of silica refractories are used in the various industries, one having lime as the bonding material and the other clay.

For making silica brick, pure quartzite is crushed and milled in a wet pan with milk of lime. The milling is done as thoroughly as possible in order that each particle of quartzite may be coated with lime and a slightly cohesive mass produced. The bricks are made by hand and partially dried, then repressed by machinery and sent to the kiln for burning.

Some hard sandstones in the coal measures in England contain enough clay in their composition to form a bond for the quartz grains when the rock is crushed and milled with a little water. This when made up into shape and burned is known as Gannister brick. A later development consists in grinding pure quartzite with plastic fireclay for the manufacture of this type of refractory.

(*Continued in next issue*).

Chemical and Metal Markets

The Quotations below represent average prices for the quantities indicated. Larger quantities may be obtained at lower figures.

TORONTO, June 10, 1918.

Though the government embargoes and restrictions have worked hardships, and in many cases injustice, to manufacturers and dealers, they have had their compensation in bringing a check upon the orgie of speculative buying that marked the course of trade last year. The slight increases indicated in chemical commodities just now are largely due to the increase of railway rates already in force in Canada and to the all round increase of 25% in rates in the United States.

The operators in nitrate of soda for munitions and chemical uses have agreed on a pooling of prices in the United States with an export price fixed at $4.05 per 100 pounds from all ports. In this case the price has been fixed by exporters without an order from the War Industries Board. The price is based on the cost of nitrates in Chili with allowances for freight, demurrage, etc., but as these will vary the price here will not remain fixed. Congress has just made an appropriation of $9,150,000 for the first of the four nitrogen fixation plants under government control.

Linseed oil continues scarce and shipments from South America are crowded out because of the need of wool, wheat and meats. There is considerable interest in vegetable and fish oils, and the fishermen of Newfoundland are said to be asking about double the last year's price of cod liver oil.

The soap manufacturers of the United States have formed a committee to confer with the government on problems arising out of the war touching their trade, Sidney M. Colgate, of Colgate & Company, New York, being chairman. This is a suggestion for like action in Canada.

Ammonia remains short in supply and has advanced in price in Canada. The restriction on trade in carbonate of ammonia in both Great Britain and the United States limits transactions in that line. Sulphur is also short, and there is a report in the Oil and Drug Reporter that the United States government is about to take over control of the sulphur mines, as a measure to settle a dispute regarding a patent affecting the sulphur production. Acetic acid has advanced.

Between fifteen and twenty new plants are now in course of construction in the United States for making denatured alcohol, and the fact that the government there has commandeered wood alcohol, acetate of lime, acetone and related products will give point to the discussion on the alcohol problem at the Ottawa convention reported in this issue. There is often doubt as to whether the two wood alcohol plants being built by the government in Tennessee will be profitable under normal conditions, but their present justification is that there is not enough wood alcohol to go round, and the war requirements reduce the supplies for other industries. The American government has let contracts for other industries. The American government has let contracts for two picric acid plants, to cost $11,000,000, one at Little Rock, Ark., and the other at Brunswick, Ga.

In the metal market the scarcity of tin continues and the price is even higher than last month, being now at a record figure of $1.25. Lead and lead products have also risen, partly due to strikes and transportation. Aluminium has been fixed by the government at Washington at 33 cents a pound in lots of 50 tons or over of 99% grade, effective from June to September 1st. Zinc has declined somewhat owing to large stocks accumulated in the chief markets. The iron and steel plants of Canada are increasing their output, but the restrictions on steel products in the United States does not afford general relief in supplies needed by Canadian industries.

Acetanilid, C.P.	Lb.	1 10—1.20
Acetic acid, commercial, crude, 28%, in bbls.	Lb.	9 .87—.10½
" " 80 per cent. pure	Lb.	.29—.33
Acetone	Lb.	.50— 55
Alcohol. grain, bbl	Gal.	8.50
Alcohol, methylated, .bbl	Gal.	1.60
Alcohol, wood, 95 per cent., refined	Gal.	1.55
Alum, ammonia lump	100 Lbs.	$6.00—6.50
Aluminum Sulphate, high grade, bags	100 Lbs.	3.50—4.00
Ammonia, Aqua .880	Lb.	.16—.18
Ammonium Carbonate	Lb.	.14—20
Aspirin (acetyl salicylic acid)	Lb.	4.00
Benzoic Acid	Lb.	5.50—6.00
Bleaching Powder, 35% drums	100 Lbs.	3.50
Borax, crystals	Lb.	.10—.10¼
Boric Acid, powdered	Lb.	.17
Calcium Chloride, fused, in drums	Lb.	.2½
Carbolic Acid, white crystals	Lb.	.90—.100
Carbon Bisulphide	Lb.	.20—.25—.30
Caustic Soda, ground, Bbl.	Lb.	.08—.10
China Clay, imported	per ton	$25—$30
Chloroform, com	Lb.	.75—.90
Citric Acid, domestic, crystals	Lb.	.90—1.00
Cobalt Oxide, black	Lb.	1.50—1.75
Copper Sulphate (Blue Vitriol)	Lb.	.11—.12¼
Fuller's Earth, powdered	100 Lbs.	6.00
Glycerine, 56 lb. tin	Lb.	.80
Hydrochloric Acid, carboys, 18°	Lb.	.03¼—.03½
Lead Acetate, white crystals	Lb.	.20
Lead Nitrate	Lb.	.18—.20
Magnesium Carbonate, B.P., bbl	Lb.	.17—.18
Nitric Acid, 36° carboys	100 Lbs.	9¼—9¾
Oxalic Acid	Lb.	.55
Phosphoric Acid, S.G. 1750	Lb.	.75
Potassium Bromide	Lb.	2.00—2.25
Potassium Carbonate 90 to 95%	Lb.	.85—95
Potassium Chlorate, crystals, Kegs	Lb.	.50—.60
Potassium Nitrate......, Kegs	(Nominal)	
Potassium Permanganate, bulk	Lb.	4.00
Salicylic Acid	Lb.	1.25—1.50
Silver Nitrate	Oz.	.90—.95
Soda Ash, bags	Lb.	.03½--.04
Sodium Acetate	Lb.	.20—.22
Sodium Bicarbonate, 100% pure	100 Lbs.	3.75—4.00
Sodium Bichromate, bbls,	Lb.	.24—.25
Sodium Cyanide, bulk, 98-99 per cent, in cases	Lb.	$ .45
Sodium Hyposulphite, kegs	100 Lbs.	3.60—4.00
Sodium Nitrate, refined	100 Lbs.	8.50—9.00
Sodium Silicate, according to density	100 Lbs.	4.00—5.00
Sulphur, ground	100 Lbs.	3.00—3.50
Sulphur, roll	100 Lbs.	4.50—5.00
Sulphuric Acid, 66°Be, carboys	100 Lbs.	3.25—3.75
Tannic Acid, commercial	Lb.	1.90
Tartaric Acid, crystals or powdered	Lb.	.88—.90
Tin Chloride, crystals	(Nominal)	
Zinc Sulphate, com	Lb.	.6½—7.00

Metals

Aluminum, No. 1, 98-99% ....base price	Lb.	.50—.60
Antimony	Lb.	.18—.19
Arsenic, white	Lb.	.15—.17
Brass, yellow ingots	Lb.	.18—.20
" red	Lb.	.27
Cobalt, metal	Lb.	2.25
Cobalt oxide, grey	Lb.	1.65
Copper, casting	Lb.	.29
Copper, electrolytic	Lb.	.30
" Am. Government price (electrolytic and casting	Lb.	.23½
Iron, bars	100 Lbs	5.25
Lead	Lb.	.09½
Magnesium	Lb.	2.75
Mercury	Lb.	2.00—2.50
Nickel, electrolytic	Lb.	.45—.50
Platinum, pure	Oz.	105.00
Silver, bar (New York prices)	Oz.	.88½
Spelter	Lb.	.09
Steel, mild	100 Lbs	5.00
" nickel, in bars, 3½% Nickel	Lb.	.25—.26
" sheet, Bessemer, 28 gauge	100 Lbs.	7.50—8.00
Tin	Lb.	1.25

Bounty on Zinc

At the recent session of the Dominion Parliament an Act was passed granting a bounty on Canadian zinc. By this Act, whenever it appears to the satisfaction of the Minister of Trade and Commerce, who is charged with the administration of this Act, that the standard price of zinc or spelter in cakes, blocks or pigs, in London, England, or St. Louis, United States, is less than nine cents per pound, a bounty may be paid on zinc or spelter containing not more than two per cent. of impurities. Such bounty shall be equal to the difference between the standard price and nine cents per pound, but shall in no case exceed two cents per pound. The bounty expires July 31, 1920. The total amount payable under the provisions of this Act shall not exceed the sum of $400,000.

Correction

In the article by Ralph Pearson, on the Royal Mint, which appeared in the May issue, the value of Yukon gold treated at the Mint should have been $5,250,000; not $57,250,000 as stated.

CLASSIFIED INDEX OF ADVERTISEMENTS

CLASSIFIED INDEX OF ADVERTISEMENTS—*Continued*

Index of Advertisements

EMPLOYMENT DEPARTMENT

The charge for condensed advertisements of "Engagements Wanted," or "Positions Open," is 50 cents per month for advertisements of 40 words or less, no charge being made for the use of box numbers in care of CANADIAN CHEMICAL JOURNAL.

ENGAGEMENTS WANTED

Chemist, B.Sc., Canadian, 27, desires change. Research experience in metallurgy and organic chemistry. Experience in metallography, micro-photography, organic analysis, testing of lubricants; liquid, gaseous and solid fuels; analysis of ores and non-fereous alloys. Salary must be attractive. Apply Box 12, CANADIAN CHEMICAL JOURNAL.

CHEMIST, familiar with gun-cotton, powder, TNT, nitric and sulphuric acids. Experienced in analysis of acids. Capable manager. Box 5, CANADIAN CHEMICAL JOURNAL.

POSITION wanted by an analytical chemist, University Graduate in Chemistry. One year's experience in large laboratory. First-class references. Apply Box 2, CANADIAN CHEMICAL JOURNAL.

Experienced chemist desires responsible position. B. Sc. of a British University, F.I.C., and a graduate of a well known technical college ; several years experience in organic research. For over five years have held present position as Chief Chemist to large firm. First-class references. Address Box 4, Canadian Chemical Journal.

A young engineering student desires a position in a chemical laboratory. Complete high school education as well as two years at Toronto University in the department of chemical engineering.—Box 16, CANADIAN CHEMICAL JOURNAL.

POSITIONS OPEN

Industrial concern located three hours from large city, wants immediately a young graduate chemist (man or woman) for analytical work. Must have good experience in routine analysis. Application forwarded to Box 14, THE CANADIAN CHEMICAL JOURNAL. State salary wanted.

CHEMICAL ENGINEERS WANTED

A large corporation about to develop a electro-chemical process on a large scale requires the services of a technically trained engineer of broad experience, preferably one familiar with the manufacture of soda ash by the ammonia-soda process.

Also

Chemical Engineer, familiar with the design and operation of electric furnaces.

Submit detailed record of training and experience and state salary desired. Send copy only of references. All negotiations will be treated confidentially.

Address Box 20, CANADIAN CHEMICAL JOURNAL.

CHEMISTS FOR MUNITIONS WORK

The Imperial Ministry of Munitions require the services of Analytical Chemists who are ineligible for Military Service, or who are not in the first class. Applications from ladies with a knowledge of Chemistry will be considered.

Apply to THE DIRECTOR OF INSPECTION,
Imperial Ministry of Munitions,
OTTAWA

CANADIAN
CHEMICAL JOURNAL
A Canadian Journal devoted to Metallurgy
Electro-Chemistry and Industrial Chemistry.

Vol. II, No. 7 | TORONTO, JULY, 1918 | 20c. a copy; $2 a year

PROFESSIONAL DIRECTORY

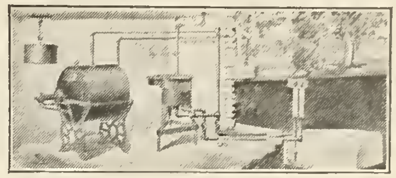

MOST IMPORTANT EVENT OF THE YEAR
GRAND CENTRAL PALACE
NEW YORK
WEEK OF SEPT. 23 -1918-
FOURTH
EXPOSITION CHEMICAL INDUSTRIES
For further particulars, address
National Exposition Chemical Industries, Grand Central Palace, New York

"VALLEIRON" APPARATUS

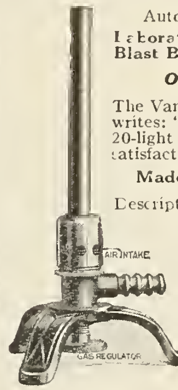
NITRIC ACID RETORTS
SULPHONATORS
ACID EGGS
FUSION KETTLES
AUTOCLAVES
CAUSTIC POTS, Etc., Etc.

VALLEY IRON WORKS
WILLIAMSPORT, PA., - U.S.A.

GAS FOR LABORATORY And INDUSTRIAL USE



The "Detroit" Combination Gas Machine



"DETROIT"
Laboratory Burner

Automatically makes the best and cheapest gas for
Laboratory Uses Operating Blow Pipes
Blast Burners Cooking in Homes Lighting, Etc.

OVER 30,000 IN DAILY USE

The Vancouver Portland Cement Co., Ltd., Victoria, B.C. writes: "We have had in use in our Laboratory one of your 20-light Combination Gas Machines, and it has given every satisfaction."

Made in both Weight and Water Driven Types.

Descriptive catalogue and names of users in your locality sent upon request.

LABORATORY BUNSEN BURNERS

Ask for Catalog of Bunsen Burners, we make the best for use on all kinds of gas.

DETROIT HEATING & LIGHTING CO.
614 Wight Street ESTABLISHED 1868. Detroit, Mich.

CANADIAN CARBIDE

Not something BETTER but the BEST is what you get when ordering "CANADIAN CARBIDE"

MADE BY

CANADA CARBIDE COMPANY, LIMITED
83 Craig Street W. - - - MONTREAL, Canada

Works: St. Catharines, Ont., Shawinigan Falls, Que.

ASK FOR THE GREEN DRUM

Over 99% **MAGNESIUM** PURE

INGOTS—POWDER
For Immediate Shipment

GENERAL OFFICES:
Power Bldg., Montreal

Shawinigan Electro-Metals Co., Limited

WORKS:
Shawinigan Falls, Que.

CANADIAN
CHEMICAL JOURNAL

A Canadian Journal devoted to Metallurgy
Electro-Chemistry and Industrial Chemistry.

Vol. 2 TORONTO, JULY, 1918 No. 7

CANADIAN CHEMICAL JOURNAL

DEVOTED TO THE CHEMICAL AND METALLURGICAL INTERESTS OF CANADA.

Published monthly by the Biggar Press Limited

540-541 Confederation Life Bldg., Toronto, Canada

Telephone Main 7399. E. B. BIGGAR, Managing Director

Subscription price, $2.00 per year to Canada, United States and all parts of the British Empire.

Time of going to press, 1st of each month. News and changes of advertisements should be in hand one week before.

Principal Contents

Back numbers of the Canadian Chemical Journal are wanted, dating from July to December inclusive. Full price will be paid for copies received with reading matter pages in good condition.

Owing to the amount of space taken by the Convention Report a number of articles have been crowded out of this issue.

To complete sets of the current volume, the publishers will be glad of back numbers from January to April inclusive, and will pay full price for undamaged copies, or will credit the amount on the sender's subscription.

SPECIAL NOTICES.

The Canadian Chemical Journal has removed from 36 Toronto Street to Rooms 540 and 541 Confederation Life Building. Our friends are welcome to our new quarters, where, with larger space, we hope to lay the foundation for a reference library adapted to the needs of the industry.

It is the intention of the publishers to be represented at the National Exposition of Chemical Industries in New York, in September, where the Journal will have a booth among the other Canadian exhibitors. We shall be glad to serve our subscribers there in any way we can.

THE Journal of Industrial and Engineering Chemistry, whose editor, Dr. Charles H. Herty, is on the society's committee which acts as advisory to the United States government, tells of the appreciation shown at Washington for the work of the chemists. The chemical service section of the National Research Council now numbers over 1,300 chemists. The harmonious and whole-souled co-operation of these experts with the various military and industrial organizations will make a story of patriotism as stirring as the exploits of the men in the air and sea and on the tented field.

IN an interview the other day Dr. Graham Bell, the inventor of the telephone, said that apart from water power, and tidal power—which we have not learned to utilize—the most promising source of power was alcohol, the greatest supply of which could be got from wood and vegetable wastes capable of fermentation. "We need never fear the exhaustion of our present fuel supply," says Dr. Bell, "so long as we can produce an annual crop of alcohol to any extent desired. The world will probably depend upon alcohol more and more as time goes on, and a great field of usefulness is opening up for the engineer who will modify our machinery to enable alcohol to be used as the source of power."

THE work involved in the general business of creating standards for any given product is not thoroughly appreciated by the average superficial observer. A matter which on the surface seems very

simple may yet require the judgment of a mature scientific mind trained through long years of growth and observation. To control a large industry in a country of great areas by means of iron-bound legal statutes in the best interests, both of the public and the industry involved, is not something to be rashly undertaken on the spur of the moment. Dr. McGill, chief analyst of the Inland Revenue Department, after due consideration, has made a new departure for America, in such work along the lines of standardizing gasoline. The growing complication of industrial life in every form makes such work both more necessary and more difficult. The article of Dr. McGill on this subject in this issue will be of general interest.

THE work of building the refining plant of the British America Nickel Corporation now going on near Hull, Que., and the opening of actual refining operations at the new Canadian refinery of the International Nickel Company, Port Colborne, Ont., this month, are two developments of national importance. Since Canadian mines supply four-fifths of the world's output of nickel, there is every reason why a corresponding proportion of the refining should be done in this country. It used to be said that the refining of nickel could not be done in Canada, but the opening of the last named plant with a present capacity of over 20,000,000 lbs. annually is a proof that the impossible can be achieved not only in regard to nickel, but the many other metals and minerals of which Canada has such a varied and abundant supply in the raw state. The works at Port Colborne are so planned that the present capacity can be quadrupled, and such an increase will mean the expansion of many a metal industry to which nickel is specially related.

IT WAS a happy inspiration which led the programme committee of the Canadian Manufacturers Association to invite addresses on the relation of chemistry to the manufacturing interests of Canada, at the annual convention at Montreal, and they were equally happy in the choice of speakers in asking Dean Goodwin, chairman of the Society of Chemical Industry in Canada, and Prof. A. B. Macallum, chairman of the Honorary Advisory Council for Scientific and Industrial Research, to deal with the subject. It was the commonly expressed opinion among the members that not only did these addresses bring a new realization of what the chemist and metallurgist can do for the nascent industries of Canada, but they lifted the discussions among the members to a higher plane. There was less heard of profits and political pull, and more of the consideration of the things that make for merit and efficiency in Canadian manufactures. Dean Goodwin historically reviewed those years during which the appeals, made by him and other educationists for science in industry, seemed like the voice of one crying in the wilderness, but his sketch of recent university work in this field, and the accomplishments reported by Dr. Macallum during the war years, undoubtedly brought home to the members the conviction that the old notion of a "Captain of Industry" as the generalissimo of the industrial army must be put among the obsolete terms, if further progress is to be made. The organization must break down if the chemist and the metallurgist are not on the general staff. That the leading men of the Manufacturers' Association are alive to the needs of the day is evident from the consideration now being given to a plan for a large subvention to McGill University and the University of Toronto for research equipment, on the lines of the celebrated Mellon Institute at Pittsburgh. We hope to give further information on this next month.

Nitrogen—A National Problem

UNTIL a few years ago there were but two main sources of the nitrates used as fertilizers, and of the nitrogen and ammonia compounds which were the base of the world's most important chemicals. These were the sodium nitrate deposits of Chili and the ammonia compounds obtained by distillation from coal. Very little of the by-products of coking coal had been recovered in America, and the control of both processes, and even the more modern discovery of obtaining nitrogen from the air by the electric arc, was practically monopolized by Germany, whose full rounded chemical industries enabled her to hold this monopoly with ease. To so great an extent was this the case that when the commercial treaty between the United States and Germany came up for revision a few years ago, the American government, realizing the urgency of greater supplies of nitrogenous fertilizers for the worn-out farms of the United States, pressed for reduction of prices and freer conditions of trade for fertilizers and chemicals, but discovered that the German government was at the back of the monopoly not only in the German industries but at the source of production in Chili. Threats of retaliation availed nothing, and the United States government submitted to the monopoly with the grace born of helplessness.

This situation, however, had its influence, when the war broke out, in determining the government and people of the United States to create within their own territory those chemical manufactures most essential to their industrial independence. After the United States entered the war one of the first problems considered was the home production of nitrogen and ammonia compounds, first, for explosives and other war chemicals, and, second, fertilizers and chemicals for the industries of peace. A commission, headed by Dr. Charles L. Pearsons, after investigating the processes in use in Europe, recommended that as the case was urgent and a steam plant could be more

quickly installed, one or more nitrogen fixation units should be established under government auspices, and Congress appropriated $20,000,000 for this purpose last year. The more efficient process, namely, that by hydro-electric power, was not lost sight of, and the large water power developments, involving an outlay of $60,000,000 were authorized, and recently these have been increased until now it is estimated that the four nitrate plants and the industries directly allied to them will employ a capital aggregating $150,000,000 including the power dams and machinery. The chief of these plants is at Muscle Shoals on the Tennessee River where, when all the works are completed, 660,000 h.p., or 85,000 h.p. more than is now in use at Niagara Falls, will be available.

For the production of ammonia and its compounds, Great Britain, whose water powers are relatively few and small, is dependent on the by-products of the coal; but Canada, with hydraulic energy of over 17,000,000 h.p. yet unused in the water powers so far measured, has here both the opportunity and the duty of stepping in to supply the Empire and other nations with those nitrogen products which can only be derived in the near future from hydraulic power, since the nitrate deposits of Chili are measurably near exhaustion.

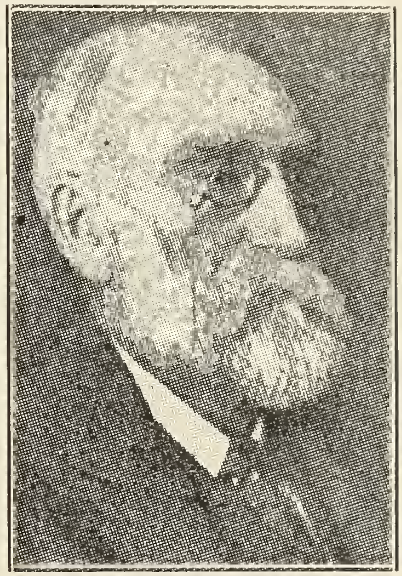
The only works on this continent converting the nitrogen of the air into a chemical product, are those of the American Cyanamid Company at Niagara Falls, on the Canadian side of the river, but the output has all been shipped to the United States for fertilizing compounds. Since the war, this company's products have been controlled by the American government and most of the output goes into war chemicals.

To a modern nation at war, the need of nitrate is as important as air and water. Dr. Thomas H. Norton, of Washington, who recently reported on the chemical situation in the United States, said: "In its ultimate analysis a modern war is reduced to the simple term of nitric acid," and in an address before the Academy of Science at Washington, Mr. S. J. M. Auld, of the British Military Mission, said: "It is within the realm of possibility that the war will be finished literally in the chemical laboratory."

Well, what is Canada doing about it? According to the answer given by the leader of the Government in the Senate it is proposed to make an investigation of the best process for the fixation of atmospheric nitrogen. But this has already been done by the United States Commission referred to, which had an advantage, that a Canadian commission would not have, of observing what had been done in Germany before the war.

The Canadian Government some years ago sent a commission through Europe to investigate the various systems of technical education. The commission made a comprehensive report in four volumes. While this report has been kept in cold storage in the Department of Labor at Ottawa, copies of it have been carefully studied by a committee of Congress in the United States and it actually forms the basis of a scheme of technical education now being put into operation.

Now here is a chance for reciprocity in the matter of nitrogen. The report by Dr. Parsons gives all the information essential as to processes. Moreover, as pointed out in last issue, the first essential is a water power plant and here is where the element of time is all-important.



Death of Dr. Douglas

Dr. James Douglas, a Canadian metallurgist of international reputation, died at his home in New York on the 25th June at the venerable age of eighty-one years.

He was born at Quebec in the year of the Canadian rebellion and at an early age became a surgeon of promise, having been the first to introduce into Canada the modern method of treating insanity. After studying medicine at Laval University he became professor of chemistry at Morrin College, Quebec. He became interested in mining through his connection with the Harvey Hill mines, and was asked to take charge of the metallurgical work of the Chemical Copper Company at Phœnixville, Pa., where he developed his electrolytic process of separating the precious metals from copper. In later years he became connected with the Phelps-Dodge Corporation of New York, of which he was chairman of the board of directors.

Dr. Douglas became wealthy, but was generous and wise in the use of his money. Among many of his gifts in scientific and philanthropic causes, he gave to the Memorial Hospital of New York nearly four grams of radium valued at $375,000, to be used in the treatment of cancer, etc. This gift represented practically the whole output for several years of the National Radium Institute. He was Chancellor of Queen's University, which by his death, loses one of its great benefactors. To Queen's he gave $50,000 to found a chair of Colonial History; $150,000 to the university library; $10,000 to a woman's residence; $20,000 for tutorships, and had offered half a million for a general endowment fund if a like sum were raised from other sources.

The American Institute of Mining Engineers gets $100,000 for a scientific library; McGill University $50,000 for a dormitory, and the Kingston Hospital $600,000. The estate is valued at about a million dollars.

Canadian Government Publications

By L. E. Westman, M.A., Inland Revenue Department, Ottawa.

[NOTICE.—Recent Government publications of scientific, technical or educational value, are reviewed here from month to month. Unless otherwise stated these publications may be obtained free, by those interested, upon application to that department of the Government issuing the same.]

Department of Trade and Commerce

During the past two months this department has issued through its Weekly Bulletin, a complete list of all regulations covering export and import of materials used in chemical and iron industries. The materials specified are listed in detail and may only be handled under direct license for purposes of export and import. It is exceedingly important that all traders in these lines should keep themselves well informed. A general review will be given here as it is impossible to give a complete resume covering all details. Such information may be obtained from the above department.

This work is handled, as far as Canada and the United States is concerned, by their War Trade Board and the Canadian War Mission, Washington. Licenses to export must be obtained from the Director of Licenses, Ottawa, and made in triplicate. Materials under supervision are classified under forms as follows: X1, X2, X3, X4, or X5. Taking the case of an American exporter as typical, his procedure would be as follows. He will fill out the United States form X in triplicate and will send the three copies to the purchaser. The Canadian purchaser will make out the necessary form X1, X2, etc., (whichever the nature of the commodity calls for) in triplicate, and attach to the application form X. This he will then send on to the War Trade Board at Ottawa. It is there considered and then passed on to the United States War Trade Board at Washington. License, or notice of refusal, will then be given to the Canadian War Mission at Washington and they will notify the original applicant forwarding his license or otherwise as the case may be.

The following materials have been prohibited from export without license from the War Trade Board.

Caustic soda.

Platinum.

Asbestos.—Application for export will be granted by the Canadian War Trade Board on the undertaking to export the shipment either to the Asbestos Trades Bureau or, if the shipment is consigned to importer the bill of lading will be endorsed to the Asbestos Trades Bureau. It is not necessary for the exporter to produce United States import license when making application to Canadian War Trade Board for export license.

Iron and steel products.—The following products come under the list of War Trade Board and are filed on form X2. Pig iron, billets, blooms, ingots, slabs, bars, alloy and high speed steel, tool steel, bars (Bessemer and open hearth), boiler tubes, fabricated structural steel, ferro-silicon, spiegeleisen, skelp, oil well casing, drive pipe, plates (iron and steel), cast iron pipe, wrought iron and steel pipe above 6 inches, wire rope or cable. The following are filed on form X: steel with no alloy except manganese under 2%, pipe under 6 inches and wire.

The following may be exported to the United States under license if going overland or by lake.

Lime, talc and soap stone, aloxite and boro-carbone, borax, cement for building, chloride of lime, cyanide of soda, dairy products, ferro-manganese, spiegeleisen, lead, magnesite, paraffin, pumice, starch, stone and stone products.

The following articles require an X2 form when making application for export license from the United States War Trade Board. The detailed list is very long and includes acetates, acetone, practically all commercial acids, wood alcohol, alloy steel and steel alloys, alum (all kinds), all ammonium salts, cobalt, copper, cyanides, carbon electrodes, carbolic acid, explosives, quebracho extract, ferro compounds, fibres, flax, glycerine, mercury and compounds, molybdenum, nitrates and organic nitro compounds, oils (castor, china wood, mustard) phosphorus, compounds of potassium and sodium, most sulphates and sulphides, sulphur, tin, titanium, toluol, tungsten, uranium, vanadium, wolframite.

Complete details with reference to the above are obtainable from Director of Licenses, War Trade Board, Ottawa.

Department of Inland Revenue

Bulletin, No. 388. Registered Feeding Stuffs, p. 21. Misunderstanding of the Commercial Feeding Stuffs Act of 1909 still seems prevalent. All feeds must be sold under a specific registration number and accompanied by guarantee of nutritive value except the following:(1) hay and straw; (2) roots; (3) unground whole grain of one kind or in admixture; (4) meal, (the product of grinding entire grain of one or more kinds); (5) wet brewers' grains; (6) bran; (7) shorts; (8) chop feed. One hundred and forty-six samples were examined and fourteen were found slightly below guarantee in fat, but compensated by protein. Twenty samples did not meet their guarantee.

Bulletin 393. Sodium Phosphate, p. 29. Collection consisted of 169 samples. A considerable deviation from the pharmacopoeal formula is observed in many of these and most of them contain decidedly more sodium phosphate than the formula demands. Although the materials used in the preparation of this salt might reasonably be expected to contain arsenic, only one sample yielded a sufficient amount to call for comment.

Bulletin 394. Wines and Liquors, p. 22. Provincial legislation has greatly changed the conditions under which these products may be sold and the tendency has been to retain the old names and yet attempt to conform to recent standards. The terms whiskey, rum, gin, wine, brandy, beer, etc., have been defined strictly under Dominion standards. Thirty-nine samples in one hundred and fourteen were sold under legally defined names and were found adulterated in the sense that they were not what they claimed to be. Manufacturers should not expect to sell non-alcoholic beverages under old names familiar to the public as alcoholic drinks. The necessity for a misbranding clause in the Adulteration Act is again evident.

Bulletin 395. Canned Corn, p. 27. The different brands collected numbered 61. Samples to the number of 168 were examined. With only one exception the net contents of the cans approximated 20 ounces. Variation of total solids was marked, ranging from 11.6 to 20.5 ounces and averaging 18 ounces. Less bleaching was evident than was found in 1911 or 1914.

Bulletin 396. Salad Oil. Cotton seed oil displacing olive oil without declaration is still considered adulteration. A list of edible fats and oils of possible use as salad oils is given. Thirty-one samples in 148 were found adulterated with mineral oil, although sold as cotton seed oil. The amount of mineral oil varied from 3 to 30% and is a new departure in the adulteration of this product on the Canadian market.

Bulletin 398. Cheese. Cheese is a defined product under G. 934 and must contain 45% milk fat. Only one sample in 166 fell below this amount and 73% of the collection reached the United States standard of 50% fat. It is suggested that the Canadian standard be raised. 35% would seem to be a maximum limit for moisture in ripened Canadian cheese.

Department of Interior

Water Resources Paper, No. 22. Manitoba Hydrometric Survey, 1916, p. 403.

M. C. Hendry. Four previous publications dealing with hydrometric data in Manitoba have been published as No.

3, 4, 7, and 19 of this series. During the year heavy precipitation was noted and the former discharge records were all equalled or exceeded. The complete history of a large number of stations is given along with much valuable data for reference purposes. Maps showing possible power sites are included.

Department of Naval Service, Fisheries Branch

Quarterly Bulletin of Sea Fishery Statistics, January—March, 1918. The Act under which pickled fish may be inspected and branded is now operating. Inspection is not compulsory, but is entirely free of charge. It is hoped that curers and packers will duly consider the benefits both to themselves and to their industry. Herring cured in the Scotch method will be inspected and branded by experts in that work. Returns by provinces showing quantities and values of all sea fish caught and landed in green state are given as well as proportion of catch marketed fresh or otherwise.

Department of Mines, Geological Survey

Museum Bulletin, No. 27. Contributions to the Mineralogy of Black Lake Area, Quebec. Eugene Poitevin and R. P. D. Graham, 1918, p. 103. The examination of mineralogical material in this district (Black Lake and Thetford) was undertaken in order that a study of the minerals found there might throw some light on the genesis of the serpentine and chrysotile-asbestos of this region. Much information relating to the origin of serpentine and chromite is given. Along with this is given a detailed technical description, including crystal drawings and complete analyses, of some 35 minerals found in the immediate district.

Memoir 103. Temiskaming County, Quebec. M. E. Wilson, 1918, p. 189. This memoir is a general statement of the results of geological work carried on for several years in the north-western part of the province of Quebec. Special reference is given to regions in the county of Temiskaming. This district is now open to fairly easy access by rail and its study is of importance as the geological succession of formations is similar in every respect to that found in the Kirkland Lake and Porcupine districts in Ontario. The area under discussion is two hundred miles long and one hundred miles east and west, adjacent to Lake Temiskaming.

Memoir 95. Onaping Area. W. H. Collins, 1918, p. 147. The work reported deals with an area seventy-two miles long and forty-eight miles east and west. Ruel station on the C.N.R., north-west of Sudbury forms a geographic centre for this district. The area is crossed by the height of land and is a hummocky, rocky plateau from 875 to 1,450 feet above the sea. The drainage is much disorganized by glaciation and lakes are exceptionally numerous. Such districts as Gowganda, East and West Shiningtree, and Wasapika fall in the northern part of this area. Eighty-seven pages are devoted to the general geology of the district and dominant features are pointed out. Under the head of economic geology the distribution of quartz veins carrying gold is reviewed. Veins have been partly opened up over a fairly large area around Wasapika and West Shiningtree Lake. A geological description of the Crystal gold mine on Wahnapitei lake is given along with an account of the gold placers on Vermilion river and Meteor lake. The silver-cobalt ore deposits at Gowganda are in narrow veins similar to those at Cobalt and associated with sills of quartz diabase. The smallness of the quartz norite sills in the central and southern part of this district makes basic segregation of copper-nickel sulphides unlikely in occurrence. Several iron ranges have been examined, but none have been found to contain sufficient iron to become producers.

Commission of Conservation

Ninth Annual Report, 1918, p. 275. To the general average technical reader the above report should prove most interesting. It is not only a report of work done and progress made on our own Canadian conservation problems, but is also a resume of the best lines to be followed in future work of this kind. At the last meeting in Ottawa the following papers were given:1. Conservation in 1917, Sir Clifford Sifton; 2. The Fuel Situation in Canada, C. A. Magrath; 3. Peat as a Source of Fuel, Eugene Haanel; 4. Forest Fire Protection in Ontario, E. J. Zavitz; 5. Forest Regeneration in Certain Cut-over Pulpwood Lands in Quebec, C. D. Howe; 6. Power Possibilities on the St. Lawrence River, Arthur V. White; 7. The Niagara Power Shortage, Arthur V. White; 8. Electrification of Railways, S. T. Dodd; 9. A Note on the Canadian "Pactolus," Mgr. C. P. Choquette; 10. The Conservation of Wild Life in Canada, 1917, C. Gordon Hewitt; 11. Salmon Fishery of the Fraser River District, J. P. Babcock. It is the intention of the Commission to give a wider circulation in future to reprints of individual papers mentioned above. The two papers dealing with the fuel situation state the facts very plainly. As a country we are just beginning to really see the problem; the solution still remains. It is pointed out in the two papers touching on forestry that only a beginning has been made by the provinces on the great problem of forest conservation from fire. The greater and more difficult problem of forest regeneration needs more fundamental data than is at present available and a much larger body of trained men to assist and direct the work. It is beginning to be admitted generally that we have overestimated greatly over our natural forest resources. "Black" pine forests have turned to "green" hardwood forests and are likely to remain such. Our pulpwood is far from being unlimited and there is really no data of much value existing concerning the real extent of our available reserves. In the natural state reforestation of desirable species is a very slow process. Owners of large limits are facing a serious problem in this connection.

In four papers the electric power question is treated in most of its phases. There is as much power available on the St. Lawrence river between Lake Ontario and Montreal as in the Niagara district. Its utilization is an international question of interest to the public on both sides of the line. The battle of public versus private ownership is continually being waged there. It would appear that the time has not yet come for the electrification of any of our trunk railway lines although such lines as have been electrified in the United States are working well at reduced cost. The question of exporting power to the United States is considered from all viewpoints.

New Acts controlling the hunting of game in the various provinces have been passed and it is hoped to retain our fur industries as they now stand and to further commercialize the big game and reindeer industries of the north on a proper basis. The most deplorable situation of all seems to exist in connection with the salmon industry on the Fraser river. This river has been so fished out in American waters that it is quite unlikely that any further "runs of the big year" will ever occur. The spawning of the salmon takes place in Canadian waters and every fourth year a very large run of salmon was made up the river. The life of the fish being only four years the industry has been practically killed by excessive fishing during years having big runs. The net loss may be calculated in millions of dollars.

The above report in extenso makes most instructive and stimulating reading.

Before five scientists in Boston on the 29th June, Garabed T. K. Giragossian demonstrated his fuelless energy producer "Garabed," which he asserts will supply the energy of the world, and, in his mind, the test was successful. An act of Congress provided for the test and protection to the inventor, and the scientists were selected by Secretary Lane from a list of fifteen submitted by Mr. Giragossian. Only the scientists and the inventor were in the room during the test. "While I did not see the test, I am convinced Mr. Giragossian proved his principle," was the comment of Judge E. C. Finney, who was sent from Washington to represent the Department of Justice.

Chemical Fertilizers and Atmospheric Nitrogen

Reference was made in last issue to the question regarding a Canadian nitrogen industry, asked in the Senate by Senator Nicholls. The following is the text of the question and answer:

Hon Mr. Nicholls inquired:

1. What arrangement, if any, has been made for the production and distribution of fertilizers to the farmers?

2. What arrangements, if any, have been made to encourage the manufacture of atmospheric nitrogen for use as a fertilizer, and also in the manufacture of explosives for military use?

Hon Mr. Lougheed:

1. No direct steps have been taken by the Government towards the encouragement of the production of mixed or compounded fertilizers by the fertilizer manufacturer, as it did not appear to be necessary, the industry being keenly alive as to the increased demand for fertilizers. Embargoes have been placed upon the export of wood ashes, a Canadian source of potash, and upon sulphate of ammonia, a valuable nitrogenous fertilizer produced in considerable quantities in Canada. An investigation was carried on in Nova Scotia to ascertain the possibility of preparing a useful fertilizer by the drying and grinding of sea weed, with satisfactory results. Though not a concentrated product, and, therefore, not one that would stand heavy transportation charges, it has been proved a valuable material for supplying two of the essential elements of fertility—nitrogen and potash. For the past two seasons it has been under field trial, especially in the Maritime provinces.

The experimental farm system, through the division of chemistry, has on a large number of its branch farms and stations throughout the Dominion, carried on investigatory work with fertilizers, and the practical results and conclusions therefrom have been given wide distribution by means of reports, bulletins, etc. In addition, the division of chemistry conducts a very large correspondence with farmers on the value and legitimate economic use of fertilizers. Special arrangements were made towards facilitating and hastening the carrying of fertilizers by the railroads.

2. The Government have been instrumental in having processes for the manufacture of atmospheric nitrogen investigated, but no arrangements have so far been made for its manufacture.

Catalogues Received

The Detroit Heating and Lighting Company, Detroit, Mich., have issued catalogues describing their copper products, their gas heating ovens and their gas heating and lighting systems for isolated plants and for country homes. The first named publication, after an introduction stating that the company have been manufacturing such special apparatus for thirty-five years, gives illustrations and details of construction of copper varnish kettles, japanning ovens, varnish kettle trucks, storage tanks, seamless copper coils for all purposes, gates, covers, measuring vessels, percolators, coating pans, kettles with steam jackets, stills for all purposes, vacuum pans, condensers, and refining apparatus for alcohol and other work, etc. There are over thirty illustrations of these appliances. The second catalogue describes and fully illustrates the many types of japanning ovens, dipping tanks with appliances related to them, which the company have made their study for over half a century. The catalogue of lighting and heating machines for laboratory work, schools and colleges and for domestic use is quite an extensive publication and gives much useful information on the working of such apparatus.

The Pfaudler Company, of Rochester, N.Y., have issued a new bulletin, known as C5, describing the company's well known glass enameled steel tanks, mixers, stills, pans and kettles for all kinds of chemical and metallurgical work. It contains 32 pages, numerously illustrated with useful tables of capacities, etc. A copy may be be obtained from the company's headquarters or any of its advertised branch offices.

The Hydraulic Machinery Company, 18 Tansley Street, Montreal, send a catalogue of machinery, comprising hydraulic knuckle joint and screw presses for all purposes with pumps, accumulators, valves and fittings; also metal working presses, forging presses, shell nosing presses, ammunition presses, and tube drawing benches.

The Canadian Ingersoll-Rand Company have just issued a new catalogue of their direct lift vertical air hoists. The booklet is well illustrated, and gives complete details of the different types of valve used for various classes of work up to five tons capacity—the dust-proof single-acting, the dust-proof air-balanced, the dust-proof double acting. Complete tables are given, including a useful table of the free air consumption of the hoists. The same company have issued a 32-page catalogue with fifteen illustrations, describing "Ingersoll-Rogler" air compressors. It sketches the development of the "Ingersoll-Rogler" valve, with particular attention to the application of the valve to large air compressors having direct synchronous motor drive. Other special features of the "Ingersoll-Rogler" compressors described are the rolling mill engine type frames, special intercooler design and clearance controller with automatic maximum load stop.

Recent Incorporations

Hamilton.—British Columbia Coal and Land Company, Limited. Henry Arnold Burbidge, solicitor. Capital, $750,000. To purchase coal, petroleum, mining and mineral land, and carry on business as engineers, smelters, etc.

Midland.—Midland Iron & Steel Company, Limited. Marcus Smith, solicitor. Capital, $1,000,000. To carry on business as smelters and refiners of ores and metals of all descriptions.

Toronto.—Wilberforce Molybdenite, Limited. John Armstrong Burgess, chemist. Capital, $250,000. To prospect for and develop molybdenite, gold, silver, copper, nickel, lead, and other mines, and to treat ores, metals and minerals of all kinds.

Hamilton.—The Monarch Metal Company, Limited. J. R. Marshall and A. B. Turner, solicitors. Capital, $250,000. To carry on business as engineers, smelters, refiners and metallurgists and to deal in metals and ores.

Medicine Hat.—The Alberta Linseed Oil Company, Limited. Walter R. L. Shanks, solicitor, Montreal. Capital, $300,000. To manufacture linseed and other oils and manufacture and deal in paints, colors, varnishes, chemicals, etc.

Toronto.—Commonwealth Chemical Corporation of Canada, Limited. John F. and Walter J. Boland, solicitors. Capital, $1,000,000. To carry on business as chemists, druggists, drysalters, oil and color men, and to manufacture and deal in paints, dyes, chemical and scientific apparatus and materials.

Hamilton.—Dominion Sheet Metal Corporation, Limited, J. R. Marshall and A. B. Turner, solicitors. Capital, $500,000. To manufacture and deal in iron, brass, copper, steel and metals of all kinds.

Woodstock, Ont.—Fig-Lax Laboratories, Limited. Thos. W. Goodyear, druggist. Capital, $50,000. To buy, sell, manufacture and deal in drugs and patent medicines.

Toronto.—Mica Products, Limited. Walter Henry Warrington, mine owner. Capital, $40,000. To acquire and operate lands for the production of minerals, metallic and non-metallic.

Toronto.—York Chemical Works. Wilfrid Field and Geo. Meredith Orr, students-at-law. Capital, $40,000. To carry on business as chemists and druggists, and to manufacture and deal in electrical, chemical and scientific apparatus.

Walkerville.—Hiram Walker & Sons Chemical Company, Limited. Harrington Edward Walker and Hiram Holcomb Walker, manufacturers. Capital, $500,000. To manufacture and deal in all kinds of mineral, vegetable and chemical substances and by-products thereof, and chemical, electrical and scientific materials.

Toronto.—Allied Drugs, Limited. Grant Cooper, solicitor. Capital, $100,000. To carry on business as pharmaceutical, manufacturing and general chemists and druggists, and to manufacture and deal in any mineral, vegetable, or chemical substance.

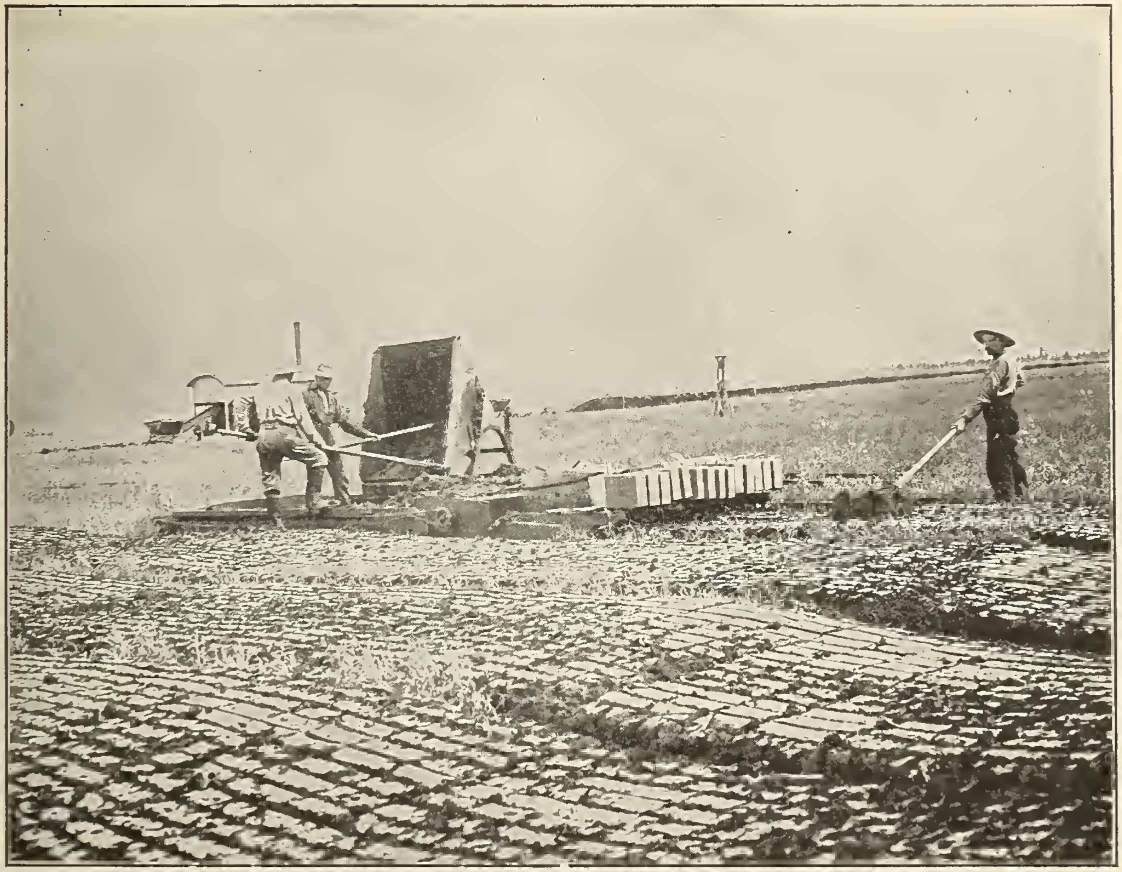
Peat Resources of Canada

From a Paper by B. F. Haanel, Ottawa, read before the Montreal Section of the Society of Chemical Industry

While the total area of Canada covered by peat bogs has been estimated to be 37,000 square miles the central provinces of Canada are possessed of peat bogs covering 12,000 square miles, and with an average depth of 6 feet. Subsequent investigations may show that this estimate is but a small portion of the total deposits actually in place.

If we assume that the peat in this 12,000 square miles is all suitable for the manufacture of fuel, a simple calculation will show that this portion of our peat resources represents a quantity of standard peat fuel (peat fuel containing 25% moisture), equivalent to over nine billion tons, which, on a basis of actual heating value, is equivalent to over five billion tons of good anthracite coal.

Whether or not a particular natural substance shall be exploited, has usually been decided from a "profit" point of view. Peat, not holding forth great prospects for fabulous profits, failed to attract the attention of the large capitalists and industrial men. This state of affairs left the creation of a peat industry in the hands of a few earnest and honest men with insufficient capital to prosecute an undertaking of this kind to a successful issue, and a few fakirs whose sole aim was to get away with the money before being found out. Without going into detail, it will suffice to say, that several attempts have been made and at many failures with loss of capital involved have been recorded. But the larger portion of the capital lost could have been saved and a flourishing peat industry long ago established if the promoters had been advised by accredited engineers who understood their business. Instead, money was expended in trying our ideas which had long ago been discarded as impracticable by the investigators and engineers of the peat using countries of Europe.



Perspective view of Drying Field; showing method of air-drying the Peat Briquettes

During the past ten years the Mines Branch has completely investigated and mapped fifty-eight Canadian bogs, all of which are situated conveniently with respect to inhabited and industrial communities, and also well situated with respect to railway and other transportation facilities. The investigations are conducted to determine the principal and controlling characteristics of a bog, viz., its area, depth, quality at different depths, quantity in tons, and, in general, its suitability for any particular purpose. The area examined in detail comprises 170,000 acres, and represents a quantity of standard peat fuel estimated at 120,000,000 tons. Seven bogs conveniently situated with respect to Toronto could supply that city with 26,500,000 tons of fuel, and seven bogs with in easy reach of Montreal could supply 23,500,000 tons of fuel. Excellent bogs are, likewise, conveniently situated with respect to thickly inhabited communities, in Nova Scotia, New Brunswick, and other parts of Canada.

The time is at hand when necessity will decide that we Canadians utilize our peat resources, and in the most efficient manner.

Description of Peat

Peat is a substance formed by the incomplete decomposition of vegetable matter either in, or in the presence of, water. The deposition of peat-forming matter may not be continuous, but occurs at irregular intervals; moreover, the vegetable matter composing the detritus laid down in the different periods may be of many and different species. Consequently, a bog of considerable depth will have represented a series of strata or layers which may comprise many different forms of plant life. The decomposition to which the various layers are allowed to proceed also may be quite different. Material composing a peat bog may consequently be far from homogeneous.

The layers composing an old and well humified peat bog are often so altered that scarcely a trace of the original plant life remains. In such cases, the peat mass is composed of such minute particles that in its natural state (associated with water) it possesses many of the properties of a colloid. The chemical alteration of the plant life entering into the formation of all peat bogs give rise to a complex hydrocarbon compound, called hydrocellulose. This is a gelatinous substance which possesses the property of absorbing many times its own volume of water.

It is a true colloid, and has properties which are of the greatest importance in the manufacturing of peat fuel.

This substance is distributed throughout the peat bog, but the quantity present in any particular section or layer is dependent on the plant life composing such portions or sections and the degree to which the humification, or chemical alteration, was allowed to proceed. This gelatinous matter is, therefore, seldom, if ever, found uniformly distributed throughout an entire bog.

The Manufacture of Peat Fuel

To simply and rapidly accomplish the removal of the water content of peat, and to convert the substance into a convenient form of fuel, has led many people to employ presses of various designs, and to briquet the residue. All such attempts were doomed to failure, since the very nature of peat prohibits the employment of pressure for the removal of the water. The water content of well humified peat cannot be reduced to below 80 to 85% by pressure alone, and even in the case of very fibrous peats, it has been only possible to reduce the water content to just a trifle below 80% by pressure. The bulk of the water content, therefore, must be removed by other means, and the other means employed always was artificial heat.

Such processes employing pressure and artificial heat are uneconomical, and, under present conditions, it may be accepted as an axiom, that any process devised for the manufacture of peat fuel which depends on the employment of pressure or artificial heat, or both, for the removal of the water content, will inevitably result in failure.

Loading hopper and buckets; Anrep automatic peat excavator

Peat, in its natural state, is generally associated with about nine times its weight of water; therefore, 1,800 pounds of water must be removed in order to recover 200 pounds of solid matter. Moreover, this solid matter not only represents the combustible substance, but also the ash and mineral matter associated with the peat.

The separation of this large quantity of water, and the handling of so large a quantity of raw peat substance, in order to obtain a comparatively small quantity of combustible matter, represent the real problems with which we are confronted when an attempt is made to manufacture peat into a fuel, on a commercial basis, and in a thoroughly economic manner.

Ignorance of the physical and chemical properties of peat, and a complete lack of knowledge concerning the results of the efforts made by European investigators, distributed over more than a century, are directly responsible for the lamentable failures with which the attempts in this country have met.

Ekenberg, a Swedish chemist and inventor, who devoted a a large part of his life to the investigation of problems connected with the manufacture of peat fuel, considered that the great dlfficulty with which peat parted with its water content was due to the colloidal substance (hydrocellulose) mentioned before. He, therefore, attempted to chemically so alter this substance that the residue resulting would, more readily part with its water by pressure alone. As a result of his study and laboratory experiments, he devised a process called after his name, the "Ekenberg Wet Carbonizing Process." The raw peat, containing upwards of 90% water, was submitted to high temperature and pressure in specially designed iron tubes. A chemical change resulted. The material was carbonized, the hydrocellulose was broken down, and a material, considerably higher in carbon and of an appreciably higher calorific energy, was produced. But this altered substance still refused to part with

the major part of its moisture through pressure. The bulk of the water still had to be removed by artificial heat. Although several million dollars have been expended on this process by an English syndicate, and about forty thousand dollars more by the Swedish Government, it is to-day not a commercial success.

Peat, however, is being manufactured economically and on a commercial scale in many of the European countries, and this industry has been expanding and growing more secure, while many in this country have been wasting time and money in efforts to make the manufacture of peat fuel more attractive, from a speculative standpoint.

The only economic process in existence to-day is that which employs the forces of Nature—the sun and the wind—for the removal of the moisture. The process employing these forces is called the "wet process," and the product obtained is termed "machine peat." This is the process which the Mines Branch, Department of Mines, demonstrated at the Government peat plant at Alfred, Ont.

the fixed knives. The fibres, stems, and pieces of wood which are often found scattered throughout a bog, are cut, torn or ground into small fragments, and the peat composing the different layers of the bog and the gelatinous substance, previously referred to, are thoroughly intermixed. This produces a homogeneous mass.

The degree to which pulping is carried is determined by regulating the opening of the spout through which the pulped material has to pass.

During the drying stage, the hydrocellulose content of the peat performs a very important function. It serves to bind the particles of the peat together, forming a concrete whole, and prevents the peat blocks from re-absorbing moisture when the drying period is interrupted by wet weather. This waterproofing of the peat block is due to the fact that the colloidal substance forms a skin covering the outside of the block, and that this skin always assumes a state of complete saturation. Hence it acts as a vehicle for conveying the moisture from the inside of the brick to the atmosphere.

30 ton "Anrep" peat machine; end elevation, showing elevator, trenching operations and track

The "wet process" consists of the following steps:

1st. The excavation of the raw peat by hand or by specially designed mechanical excavators. 2nd. The transfer of the excavated material to the hopper of a specially designed mascerator. 3rd. The transfer and spreading of this pulped peat on the portion of the bog prepared for drying purposes. 4th. The cutting of the spread peat, when sufficiently set, transversely and longitudinally into blocks, which, when dried to about 35% moisture, have the dimensions of the ordinary building brick.

The mascerator, which performs, perhaps, the most important function of the entire process, consists of a cylindrical shell, inside of which is a set of spiral rotating knives and a set of knives fixed to the inside of the cylinder. The material fed to the hopper is forced by these spiral knives through and against

The moisture evaporated from the outside of the block by the sun's heat is immediately balanced by moisture drawn from within. This equilibrium is always maintained until drying is complete.

During rainy weather, the reverse takes place; the rain brings the skin to its maximum saturation, thus preventing moisture from reaching the interior of the block.

The blocks, as the drying proceeds, contract and become denser and more resistant to breakage.

The Department of Mines manufactured, during the two seasons the Government plant was in operation, about 3,000 tons of standard peat fuel. A large part of this production was

sold at a nominal price per ton to householders in Ottawa and the towns and villages in the vicinity of the peat plant, for the purpose of introducing this form of fuel, and enabling the Department to form an opinion regarding the favor with which this fuel would meet; and one hundred and fifty of these opinions were favorable.

Cost of Manufacturing

The results of the manufacturing operations conducted at Alfred indicate that, with strict business management, peat can be manufactured for $1.70 per ton on the field. This figure includes all overhead charges, such as interest on investment, amortization, etc. The machine employed depended on hand dug peat, and, for an output of 30 tons per day, fourteen men all told were required.

The newer plant which was erected on the Government bog, after its sale to private parties, was equipped with mechanical excavators, spreader, cable-way for transporting pulped peat to drying field, and many other innovations and improvements.

Mr. E. V. Moore, who erected this plant, and operated it during the experimental stage, informed me that the results obtained showed that peat could be manufactured at a cost per ton considerably below that obtained with the Government plant.

The conditions prevailing at the time war was declared unfortunately prevented the operation of this plant under thoroughly commercial conditions.

The following is a summary of the properties of peat manufactured as described: "Peat is a clean fuel to handle; has, as a rule, a very low ash content, and produces no soot or other deposit when burned in an ordinary cook stove or open fireplace. The ash, moreover, is in a very finely divided condition, free from combustible matter, and can be easily removed from the stove or fireplace. Clinkers are not formed. On account of the ready manner in which peat fuel ignites, often a little paper or a few shavings are sufficient to start the fire. A peat fire does not, therefore, require to be kept continually burning throughout the day, if not needed, since a new fire can thus easily be started when required."*

Peat fuel, on the other hand, is more bulky than coal and is of lower heating value per pound. The relation between anthracite coal and peat fuel as regards heating value per pound is 12,500; 7,000 or 1.8:1, that is, one pound of the average anthracite coal is equivalent in heating value to 1.8 pounds of peat fuel, containing 25% moisture. For a definite heating value, therefore, it is necessary to store 1 8 times the weight of the coal required in peat fuel. The volume occupied by the peat fuel, owing to its low specific gravity, will also be much larger than that of coal. One cubic foot of ordinary furnace anthracite coal weighs approximately 56 pounds, while one cubic foot of machine peat weighs about 27 pounds. The volume of peat required to equal coal of the above heating value will, therefore, be about 3.6 to 4 times that of the coal, which is a matter of considerable moment, and introduces serious problems when large quantities of fuel must be stored."

Peat is an excellent fuel for many of the domestic purposes for which coal usually is used, and can, if certain changes are made in the design of house heating plants, be utilized in general for house heating. But peat possesses certain chemical characteristics which make it specially valuable as a source of nitrogen

* From address given by Dr. Eugene Haanel before Conservation Commission, Ottawa, Nov. 27th, 1917.

(Concluded in next issue)

MINERAL PRODUCTION OF CANADA FOR 1917

Preliminary Report by John McLeish, Chief of Division of Mineral Resources

(Concluded from May number)

Asbestos

The production of asbestos continues to increase under the stimulation of war demand. The product has been marketed at much higher prices and the total sales show a substantial increase. Stocks on hand at the end of 1917 were slightly in excess of those reported at the end of 1916.

In addition to the production in the Province of Quebec which is derived from the asbestos areas at Black Lake, Thetford, Robertsonville, East Broughton and Danville, there is also included in the record of production as given herewith, a small output of crude asbestos amounting to 10 tons valued at $2,150 produced and shipped from the Porcupine District in the Province of Ontario. These Ontario operations have been discontinued for the present, but indicate the possibilities of sources of supply other than the well known areas in Quebec.

Exports of asbestos during the calendar year 1917 were 93,932 tons, valued at $4,903,326, or an average of $52.50 per ton and asbestos and waste 52,088 tons valued at $430,956, or an average of $8.27 per ton. There was also an export of manufactures of asbestos valued at $55,666.

The exports in 1916 were 96,775 tons of asbestos valued at $3,872,463, or an average of $40.01 per ton and asbestos sand and waste, 33,564 tons valued at $241,272, or an average of $7.18 per ton; also manufactures of asbestos valued at $4,741.

Chromite

The total shipments of ores and concentrates by mine operators was 36,352 tons valued at $490,001 containing approximately 8,626 tons, or an average of about 23.7%, Cr_2O_3. A portion of these shipments was made to the Customs mill at Lakeside, Black Lake, operated by the Mutual Chemical Company and the final shipments from the district of ores and concentrates was 23,327 short tons valued at $572,115, and containing approximately 8,465 tons of Cr_2O_3, or an average of 36%. Most of the concentrates shipped averaged 50% Cr_2O_3 while a large percentage of the ore shipments averaged about 32%.

The production was as usual obtained from the Eastern Townships of Quebec, chiefly at Black Lake and Thetford, with an important contribution from the new area at St. Cyr in the township of Cleveland, Richmond county.

The mine operators shipments in 1916 were 27,517 tons valued at $311,460 and containing approximately 6,759 tons, or an average of 24.5% Cr_2O_3. Of this amount 13,268 tons were sold to a customs concentrator and the final shipments of ores and concentrates during the year was 15,249 tons valued at $310,902.

The exports of chromite as reported by the Customs Department were 19,229 tons valued at $342,528 as against 12,633 tons valued at $152,534 exported in 1916.

Coal and Coke

COAL.—The total production of marketable coal during 1917 (comprising sales and shipments, colliery consumption and coal used in making coke or used otherwise by colliery operators) was less than the 1916 production by 467,807 tons, or 3.2% in quantity, but greater in total value by $8,826,165 or 22.7%.

The exports fell off by 402,203 tons, or 18.8%, the imports were increased by 3,276,857 tons, or 18.6%, the apparent consumption increased by 3,211,253 tons, or 10.7%.

The total output of coal including waste and unmarketable slack was in 1917, 14,411,011 tons as against 14,815,703 tons in 1916.

The 1917 production included 108,225 tons of anthracite, all from one mine in Alberta; 11,135,095 tons of bituminous coal and 2,772,268 tons of lignite coal.

The imports of coal in 1917 were 20,857,460 tons of which 5,320,198 tons were anthracite.

COKE.—The total output of oven coke during 1917 was 1,231,865 short tons made from 1,978,893 tons of coal of which 1,379,038 tons were of domestic origin and 599,855 tons imported. The total coke used, or sold by producers during the year was 1,245,862 tons valued at $6,713,073, or an average of $5.39 per ton. In 1916 the total output was 1,448,782 tons and the quantity sold by the producers was 1,469,741 tons valued at $6,049,412, or an average of $4.19 per ton.

The ovens operated during the year were those at Sydney and Sydney Mines, N.S., Sault Ste. Marie, Ont.; Coleman, Alta., and Fernie, Michel and Union Bay, B.C. At the close of the year 1,657 ovens were in operation and 875 were idle.

Of the total output of coke 914,466 tons, or 74% was made in by-product recovery ovens and the recovery of by-products included: Ammonium sulphate, 9,941 tons, and tar 8,277,078 gallons as against 11,040 tons of sulphate of ammonia and 9,012,202 gallons of tar in 1916. There was also an important recovery of benzol, toluol, naphtha and naphthalene.

Fluorspar

High prices have stimulated the mining of fluorspar at Madoc, Ont., and production has increased from 1,284 tons valued at $10,238, or an average of $7.97 to, 4,249 tons valued at $68,756, or an average of $16.08 in 1917. There is an annual consumption of fluorspar in Canadian steel furnaces of from 10,000 to 15,000 tons.

Graphite

The production of graphite in 1917 which was 3,714 tons valued at $402,892 included 541 tons valued at $106,305 or $196.50 per ton from Quebec and Baffin Island and 3,173 tons valued at $296,587, or an average of $93.47 per ton from mills in Ontario.

Graphite operators reported that of the total shipment 3,510 tons valued at $372,167 were sold for export. The Customs records show exports of plumbago, crude ore, and concentrate 112 tons valued at $7,455 and manufactures of plumbago valued at $384,505. It is of interest to note that a small shipment of high grade graphite was made during the year from deposits which were worked by the Hudson's Bay Company in the vicinity of Lake Harbour on Baffin Island. This graphite was sold to the Dominion Crucible Company at St. Johns, Que., who confirm the opinion of the Hudson's Bay Company that this graphite is of very high quality and comparable with the best Ceylon product.

Magnesite

The production of magnesite was confined to the deposits in Argenteuil county, Quebec. The shipments in 1917 were 58,090 tons valued at $728,275 and include crude ore, calcined magnesite (burnt in lime kilns), and dead burnt clinker (sintered in rotary kilns after mixture with about 5% of magnesite). The crude ore was sold at about $10 per ton, the calcined at $28.50 and the clinkered, or dead burned material at from $40 to $46 per ton. The shipments in 1916 were 55,413 tons valued at $563,829 or an average of $10.17 per ton, and 14,779 tons valued at $126,584, or an average of $8.56 per ton in 1915.

Petroleum

The production of crude petroleum in 1917, while about 7,000 barrels greater than in 1916, was less than the production of any other previous year for which records are available. A bounty of 1½ cents per gallon is paid on the marketed production of crude oil from Canadian oil fields, the administration of the "Petroleum Bounty Act," being under the Department of Trade and Commerce. According to the bounty record the production in 1917 in Ontario and New Brunswick was 205,332 barrels (8,186,614 imperial gallons). The average monthly price of crude oil during the year was $2.33¼, at which rate the total production would be worth $478,937. There was also a small production of crude oil in Alberta of which record has not yet been received. The specific gravity of this oil is below the standard specified in the "Petroleum Bounty Act," and no bounty is therefore paid thereon. According to press report, based on inland revenue inspection records, there was a recovery during the year from Alberta crude oils of 294,000 gallons of gasoline and refined illuminating oils.

Pyrites

The 1916 shipments of pyrites were 309,251 short tons, containing 116,980 tons of sulphur, or an average of 37.8%, the increased production in 1917 being 93,992 tons, or 30%. By provinces the shipments were: Quebec, 130,639 tons; Ontario, 177,552 tons, and British Columbia, 1,060 tons. The Customs records show exports of pyrites during 1917 as 279,646 tons, valued at $974,200. Apparently, the exports of copper pyrites from Quebec are not included in this record. Exports of sulphuric acid during 1917 were 18,955,100 pounds, valued at $197,888, as against 3,151,700 pounds valued at $74,527 in 1916. Imports of brimstone, or crude sulphur, in 1917, were 82,445 tons, valued at $1,515,309, and 73,467 tons in 1916, valued at $1,186,618. Imports of sulphuric acid in 1917, were 216 tons, valued at $15,680, as against imports in 1916 of 2,403 tons, valued at $115,173.

Salt

The Canadian production of salt is still obtained entirely from southern Ontario and the yearly output has been slowly though steadily increasing. Total sales in 1917, including the salt equivalent of brine used for chemical manufacturing were about 138,909 tons valued at $1,047,792, as against 132,903 tons valued at $717,653 in 1916. These values are as far as possible exclusive of packages. The value of packages used in 1917 was $403,879 and in 1916, $309,603. By grades the production included: Table and dairy, 34,252 tons; common fine, 65,117 tons; common coarse, 37,398 tons; and land salt, 2,142 tons. The production by grades in 1916 was: Table and dairy, 35,045 tons; common fine, 54,596; common coarse, 41,259 tons, and land salt, 2,003 tons.

Cement

The total quantity of Portland cement sold, or used in 1917 was 4,768,488 barrels of 350 pounds each valued at $7,699,521 or an average of $1.61 per barrel, as compared with 5,369,560 barrels sold, or used in 1916 valued at $6,547,728 or an average of $1.22 per barrel showing a decrease in quantity of 601,072 barrels, or 11.2%, but an increase in total value of $1,151,793, or 17.6%.

The total quantity of cement made in 1917 was 4,987,255 barrels, as compared with 4,753,033 barrels, an increase of 234,222 barrels or 4.9%. Cement mills were slightly more active in 1917. The output was sufficient to increase stocks during the year by about 220,000 barrels whereas in 1916 the output was less than sales and stocks were drawn upon to the extent of about 620,000 barrels.

The total consumption of cement, neglecting a small export, was 4,777,068 barrels as compared with a consumption of 5,390,156 barrels, showing a decrease of 613,088 barrels, or about 11.4%.

Canadian Nitre Cake

Before the war a certain amount of nitre cake cake was produced in Canada, but no industrial use was found for it. Now this product is being made in Canada in considerable quantities for use in the Canadian paper mills, and is reported to be most satisfactory.

Every new product supplying an industry of such national importance as paper making is valuable in extending the chemical industry to which it is so intimately related.

Refractory Materials in Canada

By N. B. Davis, Geologist, Kingston, Ont.

(Concluded from last issue.)

Ordinary quartz begins to swell at a temperature of 850°C and continues to swell the higher the temperature rises, until most of it is converted into cristobalite and tridymite. If the burning of silica bricks is not carried to a high enough temperature in the manufacture they will expand, on reheating, sufficient to cause serious damage to the furnaces into which they are built.

Some trials with various occurrences of quartz when bonded with lime and clay were made in the Mines Branch laboratories.

Quartz from the feldspar mines near Verona, Ont., was bonded with 2% caustic lime and 5% plastic fireclay, and burned to cone 20 (2780°F). In both cases the quartz showed considerable expansion and destroyed the bond produced in firing, making the bricks weak and crumbly.

Quartz from a large mass in Levant township, Ont., was also tested in a similar manner and it likewise resulted in a swollen punky body.

Quartzite from Killarney, Ont., bonded with 3% caustic lime and with 5% kaolin produced a good, strong body with both bonds and only a moderate amount of swelling.

The quartzite wall rock in the kaolin mine at St. Remi, Que., is impregnated with specks and streaks of kaolin for a distance of 130 feet from the main kaolin body. An average sample of the rock contained about 11% of clay. A sample of this material was crushed and milled, made up into trial pieces, burned to cone 9 (2390°F.) in a gas kiln and afterwards to cone 18 (2714°F.) in an electric kiln. The test pieces were hard and dense, showing that fused bond had been effected between the quartz grains and the kaolin. The body was strong and showed no undue swelling on the part of the quartz. This material appears to be suitable for the manufacture of an acid refractory brick of the gannister type, as it showed no indication of softening at a temperature of 2900°F.

Quartzites of Pre-Cambrian age like those occurring at Killarney and St. Remi are also found conveniently situated at other points in Eastern Canada.

The Potsdam sandstone at the base of the Paleozoic in the St. Lawrence and Ottawa valleys is often a quartzite, but tests made on this material for the manufacture of refractory brick were not encouraging, as too much fine grained material results from crushing, and the iron content is too high. The Potsdam sandstone, however, is used as a glass sand in places where it is free from iron as at Beauharnois, Que.

Practically the same results were obtained in tests for silica brick when using the Orikany sandstones in the Devonian rocks of Southwestern Ontario. This sandstone is crushed and washed for glass sand at Nelles Corners.

A considerable quantity of white quartzite is contained in the Summit series of Lower Cambrian age in the Kootenay district, British Columbia. These quartzites outcrop on Kootenay lake at Crawford bay, and are probably the purest rocks of this kind in the province.

No tests were made of this material, but the character of the rock indicates that it might be used in the manufacture of silica brick or as a source of silica for other purposes.

The tests so far made show that all forms of quartz are not suitable for the manufacture of refractory ware. Quartzites give much better results than igneous quartz or sandstones. The sharp splintery particles which quartzite yeilds on crushing, form an interlocking bond which is essential to strength in the finished brick. Brick made from the rounded grains of sandstone lack the proper strength for handling.

Although vein quartz breaks down into splintery particles on crushing it is not a desirable material to use on account of its behaviour on heating.

Basic Refractories

Basic refractories include magnesite, dolomite, and bauxite, or the artificial product alundum, the first named being the most important. Until two years ago the production of these materials in Canada was very small; 340 tons of magnesite were exported in 1912. With the coming of the war and the consequent dislocation of trade, the American manufacturers of basic refractories hurriedly sought an American supply. Attention was turned to the occurrence of magnesian dolomite in the Grenville rocks of Quebec and prospecting in the vicinity soon developed the fact that there was considerable dolomite magnesite available. The rock is sufficiently high in magnesite to enable the shippers to meet a requirement of approximately 85% $MgCO_3$. The production has grown rapidly as shown by the following table, supplied by the Statistics Division of the Mines Branch.

Production of Magnesite in Canada

	Tons	Value
1908	120	$ 840.00
1909	330	2,508.00
1910	323	2,160.00
1911	991	5,531.00
1912	1,714	9,645.00
1913	515	3,335.00
1914	358	2,240.00
1915	14,779	126,535.00
1916	55,413*	563,829.00

Lining the bottoms of steel furnaces is the principal use to which the Grenville magnesite is applied.

For this purpose the magnesite is calcined, then broken into small fragments, and mixed with from 15% to 40% of crushed basic iron slag. It is said to give as good results as the magnesite hitherto imported from Austria.

None of the Grenville magnesite appears to be used in the manufacture of refractory brick, on account of its high lime content.

Experiments are now in progress in the Mines Branch laboratories by Mr. Frechette with the object of reducing the lime content by mechanical means. The process of separating the lime from the magnesite is based on the difference in character between these materials after slaking the calcined mass. If this separation can be carried out in practice a supply of high-grade Canadian magnesite can be placed on the market.

A considerable quantity of high-grade magnesite associated with serpentinized periodotite was found by Mr. Drysdale in the Bridge river district of the Lillooet Mining Division, British Columbia, but these deposits are situated rather too far from railway transportation at present.

The hydro-magnesite deposits at Atlin, in the northern part of British Columbia, vary from the above mentioned occurrences as they are superficial deposits in a finely divided condition and not rock masses. This material although remotely situated could be used to advantage on the Pacific Coast in the chemical industry and for the manufacture of special cements.

Where refractory bricks containing a high percentage of alumina and a low silica content are required, bauxite is the material employed in their manufacture. No record has so far been obtained of the occurrence of bauxite in Canada.

In the discussion of this paper, read at the Canadian Mining Institute, Professor M. L. Baker said Mr. Davis' paper on these refractory clays has proven very interesting to me in two or three respects. One is the disproving of the old idea that we have no residual clays in Canada. There is evidently one place in Quebec and possibly two in Ontario in which these clays have been found. I think it would be interesting to know from him, what that particular deposit on the Missanaibi River was formed from. The reason I mentioned this is that so much of Canada is occupied by similar pre-Cambrian rocks that if we knew the origin of this particular clay, we could then be on the watch for similar deposits in other parts of the Dominion, and as these

*Includes 635 tons marketed from Atlin, B.C.

residual clays are so scarce in Canada and, therefore, so valuable, it would prove of considerable interest to know of their origin. Another point in connection with this paper, of much interest, was that in reference to the manufacture of chromite brick. Within the last two or three years large areas of peridotite have been found in northern Ontario. Deposits of nickel are found associated with them, and they are almost always chrome-bearing, not in the sense that they would supply good chrome iron ore, but they almost all carry a small percentage of uniformly disseminated chromite. Peridotites weather so easily that clays derivable from these northern peridotites might prove of value in this chromite brick manufacture.

Mr. Davis replied: So far the Missanaibi river clays referred to have not been examined in detail; but all information to hand indicates that they are sedimentary in character, and probably belong to Tertiary deposits of that region. The material probably was originally derived from the weathering of Pre-Cambrian rocks. The material resulting from the normal weathering of peridotite rocks would be too high in ferruginous clay to make it of value as a refractory. It would be well for prospectors to be on the watch for white clay when prospecting in the Pre-Cambrian areas of Quebec, Ontario, and Manitoba.

The Ceramic Division of the Mines Branch is prepared to examine material free of charge.

National Exposition of Chemical Industries

The Fourth National Exposition of Chemical Industries will be held in the Grand Central Palace, New York, during the week of Sept. 23rd this year. Its advisory commitee is composed of Charles H. Herty, chairman, Raymond F. Bacon, L. H. Baekeland, Ellwood Hendrick, Henry B. Faber, Bernard C. Heese, A. D. Little, Wm. H. Nichols, R. P. Perry, H. C. Parmelee, G. W. Thompson, F.J. Tone, T. B. Wagner and M. C. Whitaker. Dr. Bacon of this commitee is now head of the Chemical Warfare Section of the National Army and a member of General Pershing's staff.

The coming Exposition will be the largest Chemical Exposition ever held and it will be necessary to use four floors of the Grand Central Palace. The exposition is a war-time necessity and regarding it as such each exhibitor is planning his exhibit that it will be of the greatest benefit to the country through the men who visit it, all of whom are bent upon a serious purpose—that of producing war materials in large quantities and constantly increasing this production till the war has been won by the allies.

The amount of floor space already engaged is greater than last year, so the managers say, the exhibits will be much more attractive and a movement is under way to show all exhibits of machinery in operation under actual working conditions as they would be found in the field. The products of the chemicals manufactured and as they enter into the world's commerce will be there as examples of what the chemist has produced in America since the world war began.

The South is again sending exhibits from some sections, and Canada, too, is taking the opportunity of presenting the materials it has available for development by the chemist and financier. There will be a group of Canadian exhibits a list of which will be published later. Technical and business men over the country should give heed to these exhibits since they will show how they can meet the war time need. A section for the Glass and Ceramic Industry has been added with which the American Ceramic Society is co-operating.

The program for the exposition is in preparation and will be a series of symposiums on the "Development of Chemical Industries in the United States, notably since 1914," embracing the war era of development.

The programme of motion pictures carries forward the idea of the symposiums, and pictures will be shown of many new industries.

Lapsed Patents

Reported by Hanbury A. Budden, 712 Drummond Building, Montreal, Que.

140,206. Oil Gas Manufacture, Lamkin & Goodwin, England. A gas producing apparatus employing a flatway tube as a vapourizer.

140,341-2. Hydrogen Separating Process, von Linde, Germany. Passing compressed mixture through a counter current heat interchanging, separately expanding gaseous and liquid portions and passing such portions through separate passages in interchanger in counter current to inflow.

140,365. Catalytic Reduction of Organic Substances, Bedford & Williams, England. Cooling gas to such a degree that the impurities solidify and then passing gas and organic substance into contact with catalyser.

140,381. Oxygen generator, Bradley, U. S. Detailed apparatus.

140,428. Production of Oxalic Acid, Lidbury, U. S. Treating a sodium with hydrochloric acid to produce insoluble chloride and oxalic acid and recovering the latter.

140,454. Tinning or zincing Metal Objects, Schrader, Germany. Objects after passing through the baths are dipped into heated boiler before being put into centrifugal.

140,536. Electro Chemical Process, Meyer & Stillesen, U. S. Reducing coal and limestone to carbon and lime by subjecting them to burning gases from electric furnace.

140,630. Reducing Gas from Peat, Oligny, Montreal. Process of treating peat and oil by heat.

140,680. Method of Reducing Fats, Pall, Germany. Acting on the substances with hydrogen below 100° C in presence of small quantities of the salts of platinum.

140,738. Lubricating Oil Manufacture, de Hemptinne, Belgium. Submitting a mixture of an organic oil with a mineral oil to the action of the silent electric discharge in a rarefied gaseous atmosphere.

140,755. Method of Electrically Cleansing Metals, Herrmann, Germany. Passing articles through a bath of non-acid solution and subjecting them to high current densities.

140,810. Wood Preserving Solution, Seidenschnur, Germany. Basic zinc compounds dissolved in aqueous solution of alumina salts.

140,819. Zinc Metallurgy, Thierry, France.

140,820. Treatment in an electric furnace.

140,831. Chrome Leather, Wolff, Germany. Treatment of cleaned and picked skins freed from hairs with a gaseous solution of chrome formate.

Printed Copies of Patents

By Hanbury A. Budden

Sir Robert Hadfield, president of the Society of British Gas Industries and head of the great firm of Hadfield, Limited, Sheffield, in a recent address on Patent Law Reform, made the following statement:

"As an example of the antediluvian policy of our Empire on this question an Englishman in this country cannot get a copy of a Canadian patent without sending to Canada, and even then he gets only a typewritten copy, as patent specifications are not printed there."

This condition of affairs in the Patent Office, Ottawa, is one that demands immediate attention. The Canadian Patent Office have issued over 180,000 patents and Canada ranks seventh among the countries of the world issuing patents for inventions. A copy of a British patent costs 8 pence, while the United States Patent Office sell copies at 5 cents apiece. A copy of a Canadian patent costs on an average over two dollars and can only be obtained after considerable delay.

In the United States Commissioner of Patents' report to Congress for the year ending December 31st, 1917, the following

figures are given relating to this subject: Printed copies of specifications and drawings of patents to the number of 2,511,082 were sold at five cents each, bringing to this Office on this account, $125,554.10. For 1,277,184 copies sold to libraries the Office received $1,612.50. The total received from the sale of copies of Patents was $127,166.50. Copies to the number of 1,097,550 were shipped to foreign Governments and 142,640 copies were drawn for Office use. The total number of printed copies of Patents distributed during the year was 5,354,136.

These figures show that there is a great demand for printed copies.

The public is interested in the publication of Patents because it has the right to know the terms of the grant of a monopoly in order to avoid infringement while the monopoly exists, and it has also the right to know what has become public property when that monopoly ceases. The patentee is interested in the publication of patents as he would readily purchase a number of copies of his patent, to assist him in exploiting his invention. The Patent Office is urgently in need of printed copies not only to supply the examiners' files, but also to fulfill an agreement with the United States Patent Office to exchange copies.

In Great Britain and the United States the libraries in all the great centres contain copies of patents for reference. In Canada it is necessary to go to Ottawa to make a search and even then the cumbrous type written copies, which are not properly classified, make a search difficult and tedious.

The Canadian Patent Act as it now stands provides for the printing of specifications and drawings in Section 63, subject to the approval of the Governor in Council.

Undoubtedly it will take a long time to print the 180,000 patents which have been already issued, but that is a matter for special consideration.

There is no doubt, however, that the system of printing specifications and drawings should be adopted at once and thus prevent the increase of arrears.

Canada has reached such a stage in her development that she should endeavour to be among the progressive nations particularly in matters that concern her intercourse with other nations. The present time of rapid industrial and technical advance demands a change from old methods which may have been suitable for a young country.

Montreal Letter

(Correspondence of the Canadian Chemical Journal By J. C. Ross.)

Montreal, June 25th, 1918.

If the chemical situation in Montreal could be summarized in a phrase it might be described as "a hand-to-mouth endeavour to keep the industry supplied." Supply houses in this city are finding it extremely difficult to apportion the limited chemicals which they are allowed to receive among the many industrial corporations clamouring for supplies. At one time in the history of the industry salesmanship was required to dispose of a shipment of goods. Now diplomacy is the first requirement, the possessor of a shipment of goods having to exercise the greatest possible care in distributing his meagre holdings among a clamouring crowd of would-be purchasers.

Owing to the export licenses required and to the fact that a large number of chemicals are embargoed, dealers are finding it extremely difficult to get sufficient supplies. Local shippers are being further handicapped through a strike of C. P. R. teamsters.

Coming down to specific lines, one finds many acute problems confronting the industry. In connection with the tanning extracts, such as extract of hemlock, the high cost of bark, labour, coal, etc., necessitates another increase of 55 cents per 100 lbs. in the price. Coupled with this advance in price is an increase in the demand, and is further complicated by the United States refusing to permit quebracho and other tanning materials to be exported except for army work. In connection with bicarbonate of soda, of which there is none made in Canada, the United States government is requiring such large quantities for the manufacture of chrome steel that the shipments to this country are being curtailed. This affects the textile and woolen trade, the chrome leather manufacturers and other industries.

In caustic soda the demand exceeds the supply and the shortage is somewhat seriously affecting a number of Canadian industries, such as the sugar refineries, soap makers and others. In the case of the sugar refineries, it is somewhat unfortunate, as the canning season is approaching when the country is clamouring for larger allotments of sugar. In aniline dyes there is also a brisk demand, largely caused by the request made in the United States for colours. It is very hard to get licenses to import aniline dyes and as a result of this, and the scarcity of material, prices are stiffening and are expected to go still higher. It is reported here that Japan, finding an acute shortage of caustic soda facing them, has cornered the markets of Australia, and at the same time is in this market for all available stocks, no matter where they originate.

Some of the best industrial chemists in Canada are now investigating how to utilize the waste by-products of the great pulp and paper industry for war purposes. It is pointed out that millions of gallons of convertible acids are now allowed to flow into the rivers as waste from the paper mills of Canada, which are capable of being salvaged and utilized for the manufacture of ethyl alcohol and used as ingredients for "T. N. T." How to utilize this waste material is one of the problems now under investigation.

The group of industries located at Shawinigan Falls, Grand Mere and district are attracting a great deal of attention from American capitalists and Government officials. Recently a large party of prominent business men from Boston, Chicago, Philadelphia, Baltimore and New York visited the industries known as the Shawinigan Group, under the chaperonage of Mr. J. E. Aldred.

At Shawinigan they visited the Power Houses, the Canada Carbide Co's plant, the Magnesium plant, Acetic Acid and Aluminum plants and also inspected the second Acetic Acid plant which is now in process of construction by the United States government. They also visited Quebec and saw its power possibilities and the Cedar Rapids near Montreal. While no official announcement was made regarding the outcome of the visit, it is surmized that further heavy investments of American capital will follow. as the visitors were greatly impressed with the possibilities of the places visited.

Another group of Americans have been examining Canadian resources. In this case a group of Americans associated with the Fuel Controller's offices visited Sydney and other coal mining properties of the Maritime Provinces. Fuel Administrator Garfield was represented by his Technical Adviser, S. H. Taylor, while others in the party were F. S. Peabody, the Chairman of the Fuel Protection Committee, United States, and various other coal men and officials connected with the Fuel Administrator's office.

The visiting delegation is acting in conjunction with Fuel Controller Magrath and probably the outcome of the visit will be a more equitable distribution of the coal resources of the two countries.

Mr. Henry Holgate of Montreal, a prominent engineer, has been appointed a member of a Commission appointed by the New Brunswick Government to probe into the affairs of the New Brunswick Power Company. The Power Company have made application to increase the streetcar fares and the rates for gas in St. John. This request is being opposed by the city, and as a result of the fight the Government has appointed a Commission to investigate and report upon the whole situation.

Mr. C. Howard Smith, President of the Howard Smith Paper Mills, Limited, and last year President of the Canadian Pulp & Paper Makers Association, has been elected President of the Montreal Section of the Canadian Manufacturers Association. Mr. Howard Smith has always taken a very prominent part in the technical section of the Pulp & Paper Association and it is believed that he will use his influence to emphasize the need of technically trained men to his fellow manufacturers in the Canadian Manufacturers Association.

At the Annual Meeting of the Dominion Steel Corporation, held here a few days ago, a very satisfactory report was published. While President Workman did not make any direct allusion to the by-products manufactured by his Company, indirect references showed that one of the big factors in bringing about the very satisfactory condition of affairs was the number of by-products manufactured by this Corporation, viz.,—Toluol, Benzol, Napthalene, Xylol, Sulphuric Acid, Sulphate of Ammonia and Coal Tar. In the olden days the Company simply mined coal and manufactured steel. Today half a score of by-product industries contribute to the swelling of the Company's exchequer.

As a result of the Quebec Government's Conservation Dams built on the St. Maurice river, there is at the present time an area of 340 square miles flooded with water which will be let out gradually during the year, thus providing the mills on the St. Maurice with an adequate supply of water throughout the year.

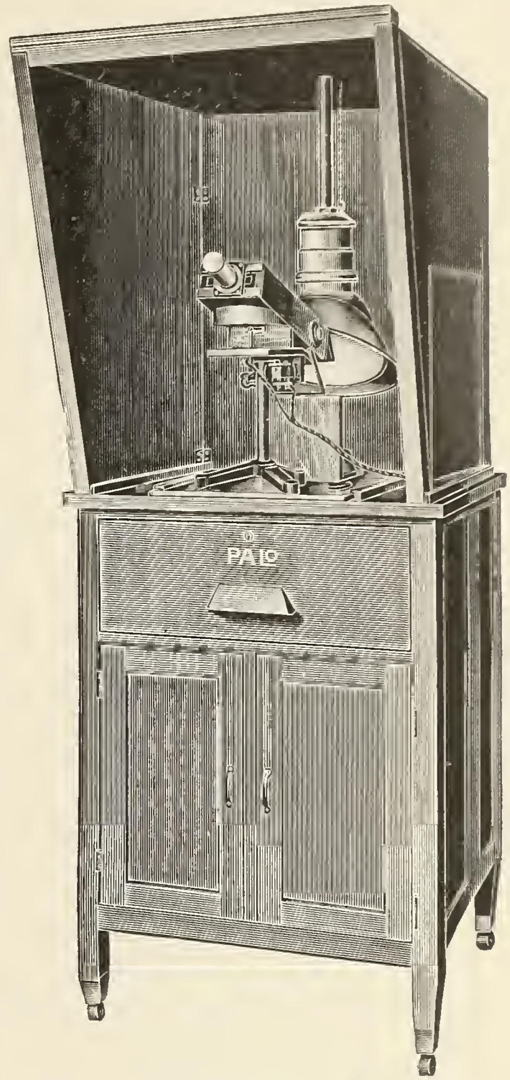
Montreal still seems to be the centre of the opium and drug trade in Canada. Recently 79 tins of opium, valued at $9,-000, fell into the hands of the police in Vancouver. It was found on investigation that the trunk containing the drug had been shipped from Montreal.

Color Problems

A means of scientifically determining and recording color values with extreme accuracy and rapidity is found in the Hess-Ives Tint Photometer which is sold by the Palo Company, New York City. It has been approved and officially adopted by the United States Government in its laboratories and in manufacturing establishments, and its general adoption for such purposes is of importance in establishing definite and communicable standards.

It is applicable to solids or liquids, using either transmitted or reflected light. Two magnesium carbonate blocks, the purest white known, are used to furnish the bands of comparison in the two halves of a circular matching field which is similar to that of a polariscope. In order to secure a standard source of light, both day and night as well as in all countries, a "Daylight" lamp of special type has been designed and found to produce uniformity throughout. This enables the operator to check, concordantly, readings taken in laboratories of other countries and regions, which feature alone very much assists the chemist who is required to check up color work obtained in other laboratories.

The instrument is set in adjustment for use as shown in the illustration. The rays of light from a Daylight lamp, placed flush with and in front of the pivoted mirror which is attached to the lower end of the instrument body, fall on the magnesia blocks. The light is reflected from these blocks into the body of the photometer through two adjustable slits, one opened and closed by a milled head screw and the other by an actuating lever shown on top of the instrument. In the body of the instrument the light passes through a revolving optical mixing wheel which is made up of a series of lenses and is revolved by means of a small motor. The function of this mixing wheel is to spread the light evenly across the respective half fields which are represented to the eye when looking into the telescope and which are divided by a vertical hair line. One field is illuminated by the standard white magnesia block and the other by the sample to be tested which is placed on the right hand block



The photometric measurements are made through three color-screens, pure red, green and blue. These screens color both circular fields but one half-field is darker than the other due to the effect of the sample. The fields are then brought to the same depth of color by moving the actuating lever over the scale which closes the aperture illuminated by the magnesia block. When the fields are matched the scale is read off and the expressions recorded.

This instrument seems particularly adapted to testing flour, oil, paper, soap, sugar, silk, wax, paint, varnish, cotton seed meal, etc.

Dominion Power Board

The question of an adequate supply of fuel and power for all of Canada is one which has been brought sharply into view as a result of the acute fuel shortages during the past two winters. Certain phases of the situation demand and are receiving immediate action through the Fuel and Power Controllers and the Honorary Advisory Council for Scientific and Industrial research. The general problem of the fuel-power requirements of Canada is one that the end of the war will not solve. It is not merely a question of looking ahead for a year or two years or for whatever time the present conflict may last, but rather a matter of providing for all time to come.

Canada is recognized as one of the greatest water power and coal countries in the world. No people enjoy to a greater degree the benefit of cheap dependable hydro-electric power and none have had this benefit more universally adapted for municipal, industrial and domestic use. Canada's resources of coal are of tremendous extent, but are so located and of such a nature that special problems must be solved before they are made available to their maximum possible extent for domestic and manufacturing purposes. The future progress of the country depends very largely on the development and use of all the available fuel-power resources. To realize this, the Government has formed a Dominion Power Board comprising nine permanent officials of the various Departments who have become, as a result of their regular departmental work, recognized authorities on various aspects of the fuel-power problems of the country. This Board has also been charged with the responsibility of co-ordinating all the investigation activities of the Government with regard to fuel power resources.

The Board has two main functions: (1) the collection of information, (i.e., Intelligence Service); and (2) to advise upon the development and use of fuel power resources of the country, (i.e., an advisory body).

The Hon. Arthur Meighen, Minister of the Interior, is Chairman of the Board. The members are comprised of the following officials:

Arthur St. Laurent, Assistant Deputy Minister, Department of Public Works.

C. N. Monsarrat, Consulting Engineer of the Department of Railways and Canals.

W. J. Stewart, Consulting Engineer to the Department of External Affairs, regarding International waters.

John Murphy, Electrical Engineer to the Dominion Railway Commission.

H. G. Acres, Chief Hydraulic Engineer, Hydro-Electric Power Commission of Ontario.

O. Higman, Chief Electrical Engineer, Department of Inland Revenue.

D. B. Dowling, Geologist, Department of Mines.

B. F. Haanel, Chief Engineer, Fuel Testing Division, Department of Mines.

J. B. Challies, Chief Engineer and Superintendent, Dominion Water Power Branch, Department of the Interior.

Foreign Trade Enquiries

The names and addresses of the firms making these inquiries can be obtained only by those especially interested in the respective commodities upon application to "The Inquiries Branch, The Department of Trade and Commerce, Ottawa," In writing correspondents should quote the number of the enquiry. The initials, "B. T. C." indicate that the enquiry for the address should be directed to the British Trade Commissioner in Canada, 363 Beaver Hall Square, Montreal.

347. A French mercantile firm, with branches in France, Switzerland and Belgium, the head of the firm now being in the French army, wishes to arrange with Canadian manufacturers and exporters for a general agency in France, Switzerland and Belgium after the war. A member of the firm is willing to visit Canada with a view to arranging special agencies in chemicals metal and other lines. The firm has in its organization departments for handling the above and would like to arrange for the exclusive representation of Canadian manufacturers.

353. A Durban Natal, wholesale druggist requests Canadian manufacturers of chemicals and drugs to submit samples and quotations to the London, England, house.

355. A South African firm of importers requests correspondence from Canadian manufacturers of bicromate of potash, to be shipped in 100 pound drums.

357. A South African firm of commission agents requests correspondence from Canadian manufacturers of caustic soda and glucose.

380. A South African firm of manufacturing chemists will be pleased to hear what Canada can offer in chemicals, especially those for pharmaceutical purposes.

387. A firm of chemical merchants in Birmingham wishes to hear from exporters of oxide of zinc.

391. Quotations are asked for on a very large quantity of creosote for a South African Government Department. Specifications on file with the Commercial Intelligence Branch of the Department of Trade and Commerce.

393. Sulphate of ammonia.—A Glasgow firm wishes to hear from exporters of the above with a view to arranging shipments to the West Indies, Mauritius, etc., at present if possible or after the war.

399. A Natal firm of engineers and merchants requests catalogues from Canadian manufacturers of a piling machine to be used on corrugated sheet steel piling, for retaining walls, bridges, etc., in connection with ferro-concrete works. Prices and details regarding delivery are requested with catalogues.

402. A South African firm of importers is prepared to take up the Canadian agency of calcium carbide. This firm has stores in each of the principal centres of South Africa.

408. A Durban firm of importers specializing in farm supplies, requests samples and correspondence from Canadian manufacturers of fertilizers.

416. A Durban firm of importers requests correspondence from Canadian manufacturers of steel suitable for concrete building of all kinds.

427. A Durban firm of merchants and commission agents requests correspondence from Canadian manufacturers of coal mining material, rails, wheel-barrows, steel plates, shovels, coal mining tools, chemicals (caustic soda, bi-carbonate of soda, Phosphoric acid, arsenite of soda), glucose, corn starch, powder, flour, lubricating oils, leather belting, agricultural machinery and implements, wrapping paper and grease-proof paper.

457. A Genoa firm would like to hear from Canadian manufacturers of chemicals for soapmaking materials and kitchen utensils.

459. A Genoa house is anxious to get into touch with Canadian exporters of minerals, oils, greases, tallows, seeds, chemical products, paints, colors and varnishes.

467. A member of a Buenos Aires firm of manufacturers' representatives, at present visiting New York, wishes to get into communication with manufacturers of chemicals, carbide, shellacs and varnishes, blueing, dry colours, etc, with the object of effecting purchases for shipments to Buenos Aires.

492. A Glasgow firm desires to receive catalogues from firms specializing in oxygen gas, oxacetylene and electrical welding catalogues.

502. A house in Milan would like to hear from Canadian firms interested in exporting wood-pulp and paper.

The War Impulse to Chemical Industry in Canada

By Theo. H. Wardleworth

Most readers of the public press in Canada today are familiar with the fact that the Imperial Munitions Board has expended during its existence enormous sums of money, totaling up to date to considerably more than a thousand million dollars, and the expenditure is still going on.

Sometimes reference is made to the extent of its operations with regard to the production of shells, explosives, ships and other manifest forms of activity, but very few realize what an important impulse has been given to the chemical industry of the Dominion by the demands and activities of the Imperial Munitions Board.

Under its control, the Board has a number of explosives plants; combining within their borders all the necessary acid lines and other sections which go to make up a complete modern factory, and this has involved a largely increased production of mineral acids and other products incident to such work. Its demands have called forth two new processes of the manufacture of acetone, and an entirely new method for the manufacture of glacial acetic acid.

The metallurgist and assayer have been busy to meet the call for metals, as we now refine in Canada, zinc, copper and lead, and this was not the case before the war. Antimony has been in demand, and supplied, but it is to be regretted that the Canadian source is no longer productive. We trust that the continued outlet for this article will cause the Canadian mines to start again.

Nickel is now to be refined in Canada, and a very large plant is being erected in the neighbourhood of Ottawa for the completion of the process of refining.

A largely increased output of electrical furnace alloys—ferro-silicon, ferro-titanium, carborundum, and electric furnace-steel—has resulted from the demands of the Imperial Munitions Board. Ferro Molybdenum has also been produced. All these alloys will play a very important part in the after-the-war industry of Canada. We have produced much larger quantities of brass and bronze, and now we have aluminium alloys and shrapnel bullets, the last two named, so far as we understand, were not produced in Canada before the war.

There has been very considerable expansion in the production of glycerine and in the output of ethyl alcohol, to meet the requirements of the I.M.B. There has been a demand for toluol and benzol, and the chemical industry of Canada has responded. Methyl ethyl ketone and butyl alcohol are now being manufactured upon a large scale, all being the result of the increased needs of the I.M.B.

It is impossible by the mere recital of the names of these chemicals, alloys, metals, and other products to visualize the vast energies set in motion, but it must be realized that it has meant an enormous increase in the activities of the technical chemist, as not one of the items mentioned can be handled successfully without the expert supervision of the factory chemist or the chemical engineer.

Old plants have been re-fitted, or new ones built to meet all these needs. Vast sums have been spent in salaries and wages, and when one becomes conscious of the magnitude of the operations, one can realize in a measure where some of the more than billion dollars have gone.

The material wealth has not been the only gain, to Canada, because, as the outcome of all these undertakings, the individual chemists, from the chiefs to the juniors have all profited by the new experience, and by the exacting demands in connection with work associated with the I.M.B.

It is gratifying to record that the I.M.B. has always taken the deepest interest in its chemists, and has followed the policy of training the younger men for better work wherever possible. It would be futile to try to forecast the influence which will be spread throughout the industrial Canada by the activities of this Board alone, but if followed up in the right spirit and in the right way, there should be in the hands of the chemists of Canada, after the war, a valuable asset in the variety of their experiences and the exactitude of their work, which should be of enormous value to the individual and to the country as a whole.

It would not be fitting to finish a review of this character without drawing attention to the great development which has taken place in the production of crude magnesite, calcined ferruginous magnesite, chrome, china clay, ochre, epsom salts, and alums; all being mined in very small quantities before the war. There is a prospect also that at an early date, we shall be able to depend upon a large source of supply of potash from the recovered fumes of cement works.

In connection with all these developments, the chemist has played his part, and they undoubtedly point to an increased demand for the plant chemist in his varying capacities.

Recent Canadian Patents

Of Interest to the Chemical and Metallurgical Industries

182,613. The process of treating nickel copper matte which consists in roasting the matte completely to oxides and converting the whole of these oxides into sulphates by treatment with strong sulphuric acid at a temperature of about 150° C., and subsequently separating the sulphates produced. Carl and Otto Langer, Clydach, Glamorgan, Wales.

182,621. A process for the production of a phosphatic fertilizer consisting in grinding phosphorite, mixing it with sodium carbonate and roasting the mixture. E. Stoppani, Bologna, and V. Volpato, Milan, Italy.

182,690. A cement structural material composed of pulverized fibrous serpentine, ground quartz, and asbestos worked in a pug mill. Rich. Van S. Mattison, Upper Dublin Township, Pa.

182,700. A paint for coating metallic surfaces subject to high temperature, comprising the reaction products of japan, powdered aluminum and clabber from soured milk. Geo. E. Rieck, Bremerton, Wash.

182,746. The process of forming urea which comprises reacting upon a metallic cyanate with an ammonium salt of carbonic acid, in presence of water, to form ammonium cyanate and an acid salt of carbonic acid, converting into urea, and separating the urea from the residues of the reaction. The Nitrogen Products Co., Providence, R. I.

182,752. The manufacture of linoleum incorporated with a titanic material. The Titanium Alloy Manufacturing Company, Niagara Falls, N. Y.

182,753. The manufacture of rubber incorporated with a compound of titanium, zinc oxide and sulphur respectively. The Titanium Alloy Manufacturing Company, Niagara Falls, N. Y.

182,770. Process of refining nickel-copper matte by converting the metals to oxides, then treating with a dilute acid to dissolve the copper oxide to form solution of copper salt, then separating residue and treating to precipitate the copper. Carl Langer, Clydach, Wales.

182,823. Process of producing pure hydro-chloric acid by distillation with a solution of zinc chloride. Wasili N. Iwanoff, Petrograd, Russia.

182,881. An apparatus for manufacturing crude calcium cyanamide consisting of a rotary furnace of reaction with feed and discharge device and nitrogen circulating system. Nobile C. Tommasi, Basel, Switzerland.

182,916. Process of treating ammonium nitrate by subjecting a moist mixture of nitrate of ammonia and an inorganic substance to a heating and drying process, maintaining agitation of the mixture. Hydro Electric Company of Norway.

182,948. An alloy for electric welding with an arc composed of iron combined with an excess of toughening agent, with the addition of a copper element to reduce the welding temperature without impairing the necessary toughness. David H. Wilson, Bergen, N. J. and Samson M. Rodgers, Pittsburg, Pa.

183,003. The process of producing ferro-silicon by charging blast furnace with ore and fuel and supplying blast of oxygen and nitrogen to reduce the silica. Joseph E. Johnson, Jr., Hartsdale, N. Y.

183,025. The method of producing soap from liquid rosin by boiling same and adding a soap residue. Frank J. Niemela, Finland.

183,031. A process of concentrating ores by flotation consisting of flowing pulped ore on to a table to which rotary and gyratory movement is given. Frederick D. S. Robertson, Toronto.

183,034. A rotary grizzly, comprising a shaft, discs, main grizzly bars and links to swing between the discs. Wm. Ross, Montreal, Que.

183,044. A decolorizing carbonaceous material containing the charred cellulose constituents of cereal fibrous material from which the resinous matter has been removed. Herbert Maxwell Shilstone, New Orleans, La.

183,074. Process for recovering zinc by passing an electric current through a zinc salt solution; 183,075-The purification of zinc bearing solutions by agitating same in the presence of finely-divided zinc to precipitate the copper; 183,076-Purifying zinc bearing solutions by an electric current; 183,077-Recovering zinc from ores by leaching with an acid solvent and electrolytically precipitating the zinc; 183,078-Zinc production by electrolysis; 183,079-Recovering zinc from ores by leaching with acid solvent, precipitating iron, and treating resultant metals by electrolyzing same; 183,080-The process of treating calcined zinc ores by precipitation and furnacing; 183,081-Process of recovering zinc, lead, copper and precious metals from ores by leaching, purifying and recovering by electrolysis, and smelting. The Anaconda Copper Mining Company, Anaconda, Montana.

183,096, 183,097. The process of plating one metal with another by subjecting the metal to be plated and the coating thereon, to heat sufficient to form a plating layer. The Metals Plating Co., New York City.

183,200. A compound for use in case hardening articles of iron and steel consisting of a carbonaceous material impregnated with barium carbonate or its equivalent. Leonard Chas. Munn, Stourport, Eng.

183,238. The decomposition of alkali and obtaining of potash from native minerals. Waitsill H. Swenarton, Montclair, N. J.

Chemistry and Agriculture

In a paper on the above subject, read before the Society of Chemical Industry at the convention in Ottawa, Prof. M. C. Boswell, of the University of Toronto, traced the growth of interest in the subject of plant life from the days of the Romans. For the first fifteen centuries the interest was mainly of a speculative nature, but some useful information was gathered as to the value of stable manure, of the ash of plants as manure, of liming, cultivation, and the advantages of the bare fallow.

From about 1630 to 1750 investigations as to the principle of vegetation were carried on. Van Helmont and Boyle believed water to be this principle, and experiments performed by them convinced them of the truth of their theory. As late as 1842 the University of Gottingen offered a prize for the solution of the problem as to whether plants get their ash from the soil or synthesize it by some process of transmutation, which prize was won by Weigmann and Polstorff by a description of experiments which the scientific world has accepted as conclusive proof that every trace of ash present in the plant comes either from the original seed or the soil surrounding the roots.

In 1650 Glauber set up the hypothesis that saltpeter (now called potassium nitrate) is the principle of vegetation, from the fact that upon applying it to the soil he obtained enormous increases of crops. In 1761 Külbel advanced the theory that the decomposed organic matter of the soil called humus is the long-sought principle.

In 1727 Boehaave taught that the plant absorbs juices from the soil consisting of animal, vegetable and mineral matter, and that this is the principle of vegetation.

The next period, from 1750 to 1800, is characterized by a search for plant nutrients. In 1756 Francis Horne published a book entitled "The Principles of Agriculture and Vegetation" wherein he described pot experiments showing the effects of various substances on plant growth. He found that saltpeter, Epsom salt (magnesium sulphate), vitriolated tartar (potassium sulphate), olive oil and many other compounds, lead to increased growth, and concludes that plant growth depends on various factors, among them being air, water, earth, salts of various kinds, oil and heat. In 1771 Priestley made his celebrated experiment of removing the product of respiration (now called carbon dioxide) from air and replacing it by dephlogisticated air (now oxygen) by means of the leaves of plants, and a year later he and Scheele discovered oxygen, prepared it and studied its properties. Priestley, however, died without perceiving the real nature of combustion, and it remained for Lavoisier to show the part which oxygen plays in it. The period from the year 1800 is characterized by more exact quantitative measurements, made possible by the discovery of oxygen, and the introduction by Lavoisier of the exact measurements of mass in chemical changes. De Saussure studied the gas changes about plants, and was able to establish the existence of their respiration processes—the breathing in of oxygen and respiration of carbon dioxide. He also established the fact that if carbon dioxide is entirely absent from the air the plant perishes. He was particularly impressed by the value of phosphates and the alkali metals in accelerating plant growth. About this period (1802-1812) Davy wrote his textbook on agricultural chemistry, rejecting, without experiment, De Saussure's belief, founded on experiment, that the chief source of the carbon of the plant is the carbon dioxide of the air, and expressing the opinion that the humus of the soil constitutes the chief source.

Up to this time experiments had been confined to either the laboratory or to small pots, but about 1834 Boussingault commenced field experiments on his farm in Alsace, to determine the composition of crops at different stages of growth and the effect of manures upon their nitrogen and ash content. In 1834 Liebig, in his report to the British Association, made an attack on plant physiologists for their inaccurate experiments and failure to familiarize themselves with the accurate work of chemists. His experiments, published in his famous textbook "Chemistry and its Application to Agriculture and Physiology" led him to the following conclusions: (1) Hydrogen and oxygen of the plant come from water; (2) Nitrogen comes from soil ammonia; (3) Certain mineral substances are essential as the alkali metals, phosphates for seed formation, and silicates for grasses and straw of grain; (4) The composition of the ash indicates the needs of the plant; (5) The good effect of lime and of cultivation is due to these facilitating the weathering of soil particles necessary in order to make the alkalies available; (6) To keep the soil fertile it is only necessary to return to it the nitrogen and mineral constituents removed by the crop. He stated his belief that when sufficient crop and soil analyses have been made it would be possible to draw up tables by which a farmer, from a soil analysis, could be told exactly what mineral constituents he must add to make his soil suitable for any given crop.

In his book Liebig insisted on the ability of the chemist to solve entirely the question of soil fertility by quantitative analysis; the determination of the constituents, particularly the alkali metals and phosphorus content of the soil, would determine the soil deficiencies.

Just at this time Mr Lawes (afterwards Sir John Lawes) commenced his agricultural experiments at Rothamsted farm, destined later to become the most celebrated experimental farm in the world. Lawes attacked in particular one of Liebig's statements—that as turnips contained very little phosphorus they require very little phosphorus in the soil for their proper development—and proved it to be entirely erroneous. A long controversy arose between Liebig and Lawes and Gilbert, but by 1855 the following points were fixed with tolerable certainty by experiments at Rothamsted: (1) Crops require salts of the alkalies and phosphates; (2) The composition of the ash of a

plant does not furnish any information as to the soil constituents it requires; (3) Non-leguminous crops require a supply of nitrogenous compounds, ammonium salts or nitrates. Without nitrogen in some form mineral manures are not effective in assisting the growth of these plants; (4) Leguminous crops are abnormal and do not require the addition of nitrogen in manure; (5) Soil fertility may be maintained for at least some years by artificial manures alone; (6) The benefit of fallowing is due to the increase of available nitrogen in the soil. Much of Liebig's work was valuable and was an incentive to others, by whom it was determined conclusively that the elements to plant growth are, potassium, magnesium, calcium, iron, phosphorus, sulphur, carbon, nitrogen, hydrogen and oxygen. Liebig's list differs from this only in the absence of iron and the presence of silicon, and recent experiments have shown the great value of silicon in growing cereals.

Lawes' farm at Rothamsted has served as the model upon which government experimental stations have been developed. For over fifty years Lawes and Gilbert (afterwards Sir Henry Gilbert) worked together with a gradually increasing staff of chemists and workmen in performing an immense number of experiments, which included experiments upon manures, artificial fertilizers, the fixation of nitrogen by the soil and by the plant, the chemical changes in the soil under various conditions, the study of various crop rotations, the composition of soils and the alteration of composition by percolating salt solutions and by the growth of various kinds of crops manured by various mixtures of artificial fertilizers and barnyard manures, the changes occurring during the bare fallow, the alteration of the physical texture of soils and its connection with improved cultivation and aeration of soil—and a multitude of other topics relating to plant growth. There are fields on the Rothamsted farm of which the chemical history has been recorded for over 60 years.

Prof. Boswell described in detail an experiment carried on at the Rothamsted farm,showing the necessity of phosphates and the effect on crop yield of added phosphates. The results of the experiment showed a remarkable development of root formation, especially in clay soils, where phosphates are applied, and also a hastening in the ripening processes of crops. The effect of phosphate starvation shows itself in depressing the yield of straw and grain, potash and nitrogen starvation also having a serious effect on plant growth. "Some conception of the importance of the application of these results to practical agriculture may be gained, by recalling the magnitude of the superphosphate industry, the stimulation to agricultural investigation resulting in the development of the potash deposits of the world and the successful syntheses of such nitrogen compounds as nitrate, ammonium salts and calcium cyanamide, all of which under improved economic conditions could not only remove forever any fear of food shortage but, if it were desirable, could produce food in wasteful abundance for the whole world."

From the success of the Rothamsted experiments, government experimental stations have been established in many countries, and in the more progressive of these stations research work is being carried on in the laboratory to determine the "mechanism" of plant growth.

A number of investigations, carried on at the Rothamsted farm and elsewhere, have fixed some of the factors which must exist in all soils.

Among these are, the physical properties of the soil, the presence in it of toxic substances, the toxic effects of salts of various kinds, the effect of the water content of the soil upon plant growth, the effect of cultivation in increasing soil fertility, and the action of organisms in the soil. About 1860 great advances were made in general bacteriology as applied to soil processes. Experiments showed that leguminous plants if inoculated with soil extract containing bacteria can develop nodules containing bacteria which have the capacity of fixing free nitrogen. Sterilization of the soil is another mighty factor to be reckoned with in the study of plant growth.

It has been the task of the chemist to separate and identify the individual compounds in plant life—the nitrates, carbon dioxide, salts of potassium, magnesium, etc.—to determine their constitutions by a study of their chemical properties, and to utilize the information thus gained with a view to definitely determining the mechanism of the plant reactions. Much of the data accumulated respecting the separate compounds of plants has had a great influence upon chemical industry, as evidenced in the development of the manufacture of indigo, the synthetic essential oil and the commercial synthesis of rubber. Recently the chemical constitution of chlorophyll (the green coloring matter of the leaf) has been worked out by Willstätter and his students. The reason why greater progress has not been made by plant physiologists lies in the fact of the great complexity of the system with which they always operate. The unravelling of the labyrinth of reactions, conditions and factors at work, by the study of the plant or cell, seem to many quite beyond the limit of human accomplishment.

Greater assistance should be given by the Government to research work in connection with medicine and agriculture, thereby laying the foundations for a more rational and rapid advance in both realms of science, by means of which a solid basis of facts and generalizations would be provided upon which the investigator could build. At present the farmer has at his disposal four general means of increasing his crop yield—drainage, cultivation, use of artificial fertilizers, and seed selection and sterilization—but in the very first of these he encounters difficulties. The tiles may, or may not, be of durable quality, or the ditches on the public highway may not be adequate to carry off the drainage water. Here the Government should step in and provide a tile made according to standard specifications, and also supervise the providing of suitable ditches to carry the drainage water from the adjoining farms, and at the same time issue a bulletin of farm law setting forth the rights and duties of farmers, township councils, roadmasters, etc. Sufficient use is not made of cultivating machinery and power tractors for hauling it. As to artificial fertilizers, the use of these by the average farmer is almost a negligible quantity, notwithstanding the immense resources at his hand.

Prof. Boswell concluded his paper by emphasizing the fact that the practice and science of agriculture has accumulated a stock of information respecting the use of artificial fertilizers, drainage and cultivation which, if applied to the acreage now under cultivation, would simply glut the markets of the world with food; that the raw materials required are either present in abundance or can be manufactured by electric power, and that effective machinery is being manufactured and sold for the carrying out of all necessary mechanical operations. The increased crop production will take time to accomplish, but with greater assistance for research in all branches of science a revolution in agriculture may be anticipated.

In complimenting Prof. Boswell on the high standard his paper had set Mr. Wardleworth the chairman, said the food problem was no longer confined to the warring nations. Not only all Europe but all America had now become conscious that a war was on. It was now the duty of Canada to provide food in greater and yet greater quantities and the solution of such questions as Prof. Boswell had raised would open the door to Canada's opportunities. He hoped the paper would be the forerunner of many such to come before the Society of Chemical Industry.

Dr. A. McGill, Chief Chemist of the Department of Inland Revenue, said the presentation of this paper enabled us to realize what a colossal subject was chemistry in relation to plant life, but it had been treated very comprehensively by Dr. Boswell, who had not failed to appreciate the humorous aspect of those enigmas perpetually before the scientist, but the solution of which seems ever to elude him. Still, progress was

being made and it would seem that Liebeg was able to establish that if you only give a plant what it needs, nature will look after the rest. In the meantime we have to acknowledge that without life nothing comes, and the source of plant life, as of animal life, is still a mystery. Now that we have in Canada a Union Government and party influences are to be subordinated to the public interests, the appropriation of more money and more effort to agricultural chemistry, which touches the whole field of chemistry, ought to be an easy step. The government reports show that private exploitation of the farmer in the matter of artificial fertilizers requires to be guarded against. No sooner is one new want made known to the farmer than some interested parties come forward with their nostrums to take advantage of him. If they could only get the farmer to read the government reports it would save him many a loss and disappointment.

Dean Goodwin of Queen's University, desired to add his appreciation of the wide scope and authority of Dr. Boswell's paper. Every works chemist, as well as every university man, is interested in the application of chemistry to agriculture; for the chemist in whatever special work he may undertake is tracing a circle which inevitably brings him back to the soil. Investigations of phosphates, super-phosphates, sulphuric acid, sulphate of soda, nitrates, nickel, and other ores are cases in point. The relation of ores and of metals such as copper wire, to the production of carbide and other electro-chemically made materials evolved by the hydraulic powers of Niagara, Shawinigan Falls, etc. are other illustrations which show that all roads lead to agriculture and the soil.

Dean Ellis, of the University of Toronto, suggested that a paper of such value should be printed in full for general information.

Prof. R. Harcourt, Guelph Agricultural College, said he appreciated the paper and also endorsed Dr. McGill's remarks on the numerous attempts made to exploit the farmer, to whom so much reading matter was given which conveyed so little real knowledge. We cannot stop at the solution of the kind of food a plant wants. We want to know how and under what conditions it is to be given, and these points show how difficult it is to prescribe for the treatment of a soil from a sample sent in without any explanation of the situation of the land. A package of soil received as dry as powder may have been taken from the bottom of a lake. There is so much we do not know and it is so hard to make the proper application of what we do know that we have a long way to travel yet. One difficulty is to get trained men as investigators, and trained men in making application of the acquired knowledge on different soil and climatic situations.

Mr. F. J. Hambly, of Buckingham Que, thought the important question was, how can we get the result of chemical research before the people who are to benefit from it? One thing seemed clear to him, and this was that there should be improved methods of education in the primary schools of Canada where elementary chemistry and physics should be taught at an earlier age and in a more practical way. We cannot wonder at the inability of getting the present generation of farmers to apply a knowledge when he has lacked the opportunity of knowing the elements of soil chemistry, and it will take years of education among the coming generation before much improvement can be expected.

Mr. A. J. MacDougall, Toronto, said that most of the publications issued by government impressed on the farmer the necessity of connecting their practice with science. Of the problems raised by the paper one important one was the function of moisture in soil. Of 100 lbs of moisture what percentage goes into plant life and what is lost?

Dr. Boswell said there were many factors entering into such a problem. He thought there should be a propaganda among manufacturers as well as among farmers to teach them the value of a knowledge of chemistry in their business. Many, however, are trying to do research work without the equipment necessary to determine some of the fundamental factors underlying the specific tasks of the manufacturer and the farmer. Hence government should be impressed with the need of greater help for universities.

Mr. M. F. Connor, Ottawa, said that an observation of agriculture in the Gatineau Valley showed that there was practically no improvement in the methods of farming in the last 25 years, and it would seem that demonstrations undertaken on one or more of such farms would bring about a change for the better.

Prof. Harcourt remarked that the Ontario government had used as much as a page in the agricultural papers to give timely information. The value of such information is qualified by the differences in soil, season and situation, and these continually vary.

The chairman remarked that many investigators, such as Burbank, accomplished wonders with little or no government help. We have wealthy men, like Sir William Macdonald, who by their great generosity, had helped to make science independent of the politician. The great results of the Mellon Institute, at Pittsburgh, were another illustration.

After further discussion by Messrs. Mason, Schorman and others, a vote of thanks was passed to Dr. Boswell.

Our May number contained a "personal" stating that Mr W. R. Leadbeater, M.A., formerly chief chemist at the Dominion Sugar Company at Wallaceburg, Ont., had taken a position with the Wayagamack Pulp and Paper Company at Three Rivers, Que. Since then news came that on May 12th Mr. Leadbeater disappeared, and had not been heard of since. It was feared that he had been drowned in the river. The report that his body has been recovered from the St. Maurice River is now confirmed.

Society of Chemical Industry.

The complete list of members of the Committee on Organization appointed at the Convention of the Society of Chemical Industry at Ottawa is as follows: Dr. M. A. Parker, University of Manitoba; Dr. A. McGill, chief chemist Inland Revenue Department; Joseph Race, F.I.C., city bacteriologist, Ottawa; Dr. J. S. Bates, Forest Products Laboratories, Montreal; Dr. L. F. Goodwin, Queen's University, Kingston; I. Grageroff, Canadian Explosives, Limited, Montreal; Prof. E. G. R. Ardagh, University of Toronto; Dr. D. McIntosh, University of British Columbia, and Harold J. Roast, James Robertson Company, Montreal. Dr. Parker is chairman and Mr. Roast, secretary. The address of the secretary is 393 Guy Street, Montreal.

Convention Report.

Editor The Canadian Chemical Journal:

Sir,—My attention has been called to your published report of the Canadian Chemists' Convention, which appears in your current (June) number, and in particular to the remarks attributed to me on page 148. Several of the statements there printed are untrue and were not made by me. The paragraph does not represent the sense of what I said.

Kindly publish this letter in the next issue of The Canadian Chemical Journal. Yours faithfully,

ALFRED TINGLE.

Department of Customs, Ottawa,
June 18, 1918.

[In reply to the above note we asked the writer to send us the text of what he said which was not correctly reported. He declined to do so. Our reporter for this convention was the most reliable obtainable in Ottawa; and as we have received a number of letters from other members congratulating us on the account of the convention we have every reason to think the reporter did his work well.—Editor.]

Ferrocyanide Method of Determining Zinc in Bronze

By Ernest Nyman*

The approximate composition of the bronze analyzed was:

Cu, 60 to 90%; Pb., 5 to 20%; Sn, 5 to 8%; Sb, 0.2 to 0.4%; Fe, Trace to 0.3%; Al, trace; Zn, trace to 10%.

The Method

Weigh out 0.5 g. of drillings into a 200-250 cc.beaker. Add 8 cc. conc. HNO_3 and boil gently down to 3-4 cc. Add 50 cc. hot water and boil 4 minutes. Add NH_4OH (1-1), 20 cc. in excess, and about 1 g. $(NH_4)_2CO_3$. Cover the beaker with a watchglass and boil gently for a couple of minutes; filter by suction through a Gooch. Wash a few times with small portions of NH_4OH (1-1), finally with hot water. Transfer the filtrate to a 350 cc. beaker, acidify with conc. HCl, 10 cc. in excess, cover with a watchglass and boil till bubbles of CO_2 cease to be given off (a few minutes). Cool to about 70°C. and lead in, for 10 minutes, H_2S into the solution, measuring 150-200 cc. Filter by suction through a Gooch and wash a few times with hot water. Transfer the filtrate to a 350 cc. beaker, concentrate the solution by boiling to about 150 cc. Make ammoniacal to litmus paper, then just acid, heat and titrate at 67°-79°C. with Stand. $K_4Fe\ Cy_6$ solution, running in a drop at a time and stirring energetically with a glass tube, about 4 m.m. in diameter, and using Uranylacetate solution (4%) as an external indicator on spotplate. The end point is the change, within 5-10 seconds, of the greenish yellow color of the indicator to a very faint reddish brown, when one drop of the solution is brought into contact with one drop of the indicator.

Discussion

The Sb and Sn in the bronze are converted into insoluble oxides by the conc. HNO_3.

The NH_4OH and $(NH_4)_2CO_3$ precipitate the Pb as a basic carbonate and Fe and Al as hydroxides. Cu and Zn dissolve as Copper ammonium and Zinc ammonium compounds.

Note 1. Care must be taken not to boil the solution too long after adding the $(NH_4)_2CO_3$ or some basic zinc carbonate may precipitate.

Note 2. The solution, when the Cu is precipitated by H_2S. must be satisfactorily acid as indicated in the method or some Zn will be carried down with the CuS.

Note 3. In the titration of an acid $ZnCl_2$ solution (as in this case) two successive compounds are formed, according to the equations:

$2ZnCl_2+K_4FeCy_6=Zn_2FeCy_6+4KCl.$

$3Zn_2FeCy_6+K_4FeCy_6=2Zn_3K_2\ (FeCy_6)_2.$

Thus a double ferrocyanide of Zn and K is formed in an acid $ZnCl_2$ solution.

In an alkaline solution, again, a salt is formed that closely has the composition of the normal salt Zn_2FeCy_6.

The factors of the ferrocyanide in an acid and an alkaline solution, therefore, not being identical, care must be taken to have the solution properly acid.

Note 4. Too high values on Zinc will result by having the solution, when titrating, too acid and too hot, because increasing amount of acid and heat, above that stipulated in the method, tend to decompose the ferrocyanide, accompanied by a turning of the solution to a bluish green. This decomposition, most probably runs in line with the following two equations:

(1) $2K_4FeCy_6+6HCl=FeK_2.\ Fe\ Cy_6+6KCl+6H\ Cy.$

$FeK_2.\ FeCy_6$, Ferrous di-Pot. ferrocyanide, a white amorphous salt is formed, that quickly on exposure to air oxidizes acc. to the equation:

(2) $2FeK_2.\ Fe\ Cy_6+2HCl+O=Fe_2K_2\ (Fe\,Cy_6)_2+2KCl+H_2O.$

Ferric di-Pot. ferrocyanide, is formed, coloring the solution bluish.

With Ferric salt, contaminating the solution, the ferrocyanide without excess of acid and heat, forms the Ferric-ferrocyanide or insoluble Prussian blue:

$4FeCl_3+3K_4Fe\ Cy_6=Fe_4\ (FeCy_6)_3+12KCl.$

And with Ferrous salt:

$2FeCl_2+K_4FeCy_6=Fe_2.\ FeCy_6+4KCl.$

$Fe_2,\ FeCy_6$, Ferrous-ferrocyanide, a white salt is formed, which rapidly oxidizes to the Ferric salt:

$3Fe_2.\ FeCy_6+3HOH+O_3=Fe_4\ (FeCy_6)_3+2Fe\ (OH)_3.$

In all these cases the solution when titrating, turns a bluish green, showing up a faulty working and giving too high Zinc values.

It is proper to observe whether a precipitate forms, when making the solution ammoniacal before acidifying for titration. Iron may in some way have entered the solution by contamination, e.g., by the H_2S used during the operation, and at this point of the analysis should be eliminated by filtration.

Note 5. Oxidizing agents, present in the solution, cause high results also, e.g. chlorine attacks the ferrocyanide:

$2K_4FeCy_6+Cl_2=2K_3FeCy_6+2KCl.$

Pot. ferricyanide is formed, turning the solution a reddish brown.

Note 6. If the Cu is not fully precipitated with H_2S. the solution turns a reddish brown owing to the formation of cupric-ferrocyanide:

$2Cu\ Cl_2+K_4FeCy_6=Cu_2Fe\ Cy_6+4KCl.$

Note 7. The reddish brown precipitate of Uranylferrocyanide, $(UO_2)_2\ FeCy_6$, indicating the endpoint, is formed by the first excess of ferrocyanide, after all the Zn is precipitated, acting on the Uranylacetate acc. to the equation:

$2UO_2\ (CH_3CO_2)_2+K_4FeCy_6=(UO_2)_2FeCy_6+4CH_3CO_2K.$

The Uranylferrocyanide is easily soluble in fairly strong hot HCl and proportionally soluble in weaker acid; an excess of HCl in the solution, therefore, tends to give higher values on the Zinc.

A 4% solution of Uranylacetate has shown itself to give the best service. One drop from the dropping flask is quite enough, a smaller drop giving a sharper endpoint than a larger one.

Note 8. The ammonium chloride (also some NH_4NO_3) formed in the solution by successive addition of NH_4OH and HCl opposes the tendency of hydrolysis of the $ZnCl_2$, acc. to the equation:

$ZnCl_2+HOH=Zn\ (OH)\ (Cl)+HCl.$

The NH_4Cl, also speeds up the formation of the $Zn_3K_2\ (FeCy_6)_2$ and assists its settling, thus fixing the endpoint sharper.

The amount of NH_4Cl in the C.P. zinc solution, when Standardizing the ferrocyanide and in the Bronze-Zinc solution should be about the same, which is accomplished by working as "the method" and the Standardization (see below) indicate.

Standardization. Dissolve 21.5-22 g. of crystallized C.P. $K_4FeCy_6.\ 3H_2O$ in water and make up to one liter (1 cc. precipitates about 0.005 g. Zinc.)

To standardize the ferrocyanide use C.P. Zinc or C.P. Zinc Oxide. Because zinc oxide is somewhat hygroscopic, it must, before use, be ignited in a Pt. crucible for several minutes, cooled in a desiccator and kept in an airtight vessel.

$ZnO\times0.8035=Zn.$

Dissolve an amount of the C.P. Zinc corresponding to the approx. amount in 0.5-1 g. drillings in 50 cc. HCl (1-1) in a 200-250 cc. beaker. Make ammoniacal, then just acid to litmus paper, dilute to about 150 cc. heat and titrate at 67°-79°C. with the ferrocyanide, and from the reading deduct a blank of 0.25 cc., the same blank being deducted when the sample is titrated.

Note 1. There is actually no difference as to the amout of Zinc to be taken, when standardizing the ferrocyanide. Amounts of C.P. Zinc varying between 0.015-0.25 g. have given the same factor, experimental errors allowed. The necessary and

*Chemical Engineer, Milton Hersey Co., Winnipeg.

satisfactory thing is to have the temp. at 67°–79°, the volume of the solutions and the amount of NH_4Cl and the conditions, generally, exactly alike (e.g. the amount of the solutions used upon the spotplate). But, absolute identical conditions being difficult to obtain, the taking of an amount of C.P. Zinc, when standardizing, corresponding to the amount in 0.5–1 g. of the sample of the drillings, accelerates the analysis and makes easier the obtaining of correct results, especially when the approx. the same kind of bronze is run as a routine.

Note 2. The stirring, when titrating, must be done vigorously so as to make impossible any occlusion of the zinc solution or ferrocyanide by the precipitate formed.

Note 3. The temperature of the solution, when titrating, is highly important and must be kept at 67–79°C. Above 80° the evil effects of too high heat, as outlined above, appear; below 65°, again, the tendency of the endpoint color is to show up before all the Zinc is precipitated and also shows less sharp, causing too low or doubtful results; this, because the reaction between the ferrocyanide and the Zinc salt at low temperatures proceeds slowly and an occlusion, occurs of the reacting salts by the precipitate formed.

To be able to titrate at a temperature of 67–79° it is necessary to have the beaker with the solution at a regulated heat during the titration e.g. on two asbestos pads resting on a tripod and separated from each other by an iron ring about 1 cm. in height, and observe the temperature on a thermometer suspended at the circumference of the solution.

Note 4. The right state of the solution, when the end-point is reached, is that of a milky colloidal white, all of the flocculent precipitate of the Zincferrocyanide, at the moment of the end-point, having changed into the colloidal precipitate of the double compound of Zinc and Potassium. The nearer the end-point is approached the more pronounced the colloidal milky state of the solution becomes and an experienced manipulator will be able to know the true end-point of the reaction without having to resort to the external indicator.

Conclusion

The ferrocyanide method, when strictly adhered to as outlined above has proved itself to give values about 0.10% higher than when the same bronze sample was run by the gravimetric pyrophosphate method. The gravimetric method, generally, is considered to give somewhat low results, therefore the superiority of the ferrocyanide method, in this respect, follows. Worked by the hands of an experienced operator this method, also, is run in a much shorter time than the gravimetric method and enables the operator to run the Zinc parallel with the other metals in the bronze. Its use, also, for brasses, and allied alloys seems promising.

Industrial News

The mill to be erected by the Canada Copper Corporation at Copper Mountain, B.C., will have a capacity for treating 2,000 tons per day and will be the second largest mill in British Columbia.

The Algoma Steel Corporation, at Sault Ste. Marie, is building a plant for the manufacture of silicon brick for the company's own use. It is expected that the twenty-five new coke ovens under construction at these works will be completed this month. These will make a total of one hundred and thirty-three coke ovens in operation here.

Work on the million dollar government chemical plant at Niagara Falls, N.Y., referred to last month has been stopped on orders from the United States Government. The reported reason is that the chemists have discovered an improved process of production.

Dr. W. W. Andrews of Regina, is investigating the greensands of Saskatchewan with a view to determining their potash content.

Extensive deposits of nickel and copper ore of a high grade have been reported in the Eardley Mountains, near Luskville, Que. The property is over 500 acres in extent.

The Canada Metal Co., Ltd., Toronto, have completed their Vancouver branch factory, and are now manufacturing babbit, antifriction, stereotype and other metals.

The Quebec-Saguenay Pulp Company, Limited, has just been organized with mills at Delmas, on the Peribonka River, in the Lake St. John district, Quebec. The offices are at 603 McGill Building, Montreal.

Mr. A. M. Huestis representing the Kalbfleisch Corporation, of New York, has removed to larger offices No. 15 Mail Building Toronto, where he will have better facilities for taking care of increased business.

The Maritime Linen Mills, Limited, has been incorporated with a capital of $24,000 to manufacture worsted and linen goods. The new company will establish its plant at Moncton, N.B., taking over the machinery and raw material of the Eastern Linen Mills, formerly of Dorchester, N.B.

The remarkable exhibit of the National Aniline and Chemical Co. at the Grand Central Palace, New York, illustrating the evolution of the American dye industry, was moved to Boston, where it was shown in the "made in U.S.A." exhibition organized by the Jordan, Marsh Co.

An act has been passed in British Columbia empowering the Government to pay bounties on iron and steel produced within the province, as follows: on pig-iron from ore mined in the Province, a bounty not to exceed $3.00 per ton; on pig-iron from ore mined outside the province, a bounty not to exceed $1.50 per ton—which bounty may be paid upon the molten iron from ore entering into the manufacture of steel by the process employed in electric, Bessemer or other furnace. No bounty shall be paid under the Act after December 31st, 1923.

The Canadian Consolidated Mining & Smelting Company, Trail, B.C., has issued a notice recently to its employees to the effect that, owing to the largely increased cost of production as well as the increased taxation, it will be necessary to suspend shipments from the Rossland mines indefinitely, but that a small force will be kept on development work in Rossland while the remainder of the employees will be distributed among other silver-lead properties of the Company. It is the intention of the company to keep only one copper furnace at theTrail Smelter in operation.

The Beaver Cove Lumber and Pulp Company, recently incorporated, has a force of men at work at Beaver Cove, 165 miles north of Vancouver. The head office will be in Vancouver, with Mr. W. H. White, of Boyne City, Mich., as manager and Mr. G. C. Pratt, secretary-treasurer. The first unit of the pulp mill will have a capacity of forty tons of sulphite per day. The Company own about five billion feet of timber.

On May 24th the United States Oil Director, Mr. Requa, announced that the price of gasoline had been fixed at 21 cents a gallon to the Allies at Gulf ports and 23½ cents at Atlantic ports. This was at a time when gasoline for export was quoted in New York at 40 to 55 cents, according to gravity and quantity, and since then, as transportation factors have increased the price quotations for export have been withdrawn. Meantime the hunt for new oil fields continues. Besides the discovery in the Sudbury district further tests are being made in the Peace River region and the tar sand districts of the Athabaska are being investigated. The Imperial Oil Company is reported to be planning to drill in this region. The Empire Oil and Natural Gas Company of Vancouver are drilling in the Fraser Valley near Vancouver.

Notes from New York

Correspondence of The Canadian Chemical Journal, by F. M. Turner, Jr.

New York, June 29, 1918.

At a dinner of the Sales Convention of the American du Pont Industries at Atlantic City last month, Dr. Charles J. Reese, chemical director of the du Pont Company stated that the company had established eighteen fellowships and thirty-three scholarships in chemistry in various colleges and universities. The value of each fellowship is $750, and of each scholarship, $350. The du Pont Company has taken this action because of the growing importance of chemistry in the industries of the world, and because of the scarcity of trained men due to the drafts made for the army and the remunerative offers made to men who have not even finished their courses in college. There is hardly a big manufacturing industry in America to-day not in need of men who have finished their course in chemistry.

Chemists and Military Service

Secretary Baker has issued orders to the proper military authorities whereby the United States is to get the full benefit of the special knowledge possessed by graduate chemists who have been taken into the military service. The orders mobilize a big force of highly trained men who possess qualifications for working out numerous chemical details coming up in regular army work. Under the War Departments' orders all enlisted chemists have been listed for transfer from divisions in this country to the nearest depot brigade. Commanding officers have been instructed to report every graduate chemist serving under them to the department, stating each man's special line and whether he is being employed on chemical work or not. It is directed that all chemists now in depot brigades, or to be received by such brigades hereafter, will be assigned to different organizations or to different service by means of orders direct from the department. No enlisted man who is a graduate chemist is to be sent overseas except upon chemical service. The chief of the Chemical Service Section will list every graduate chemist in the country, whether already in army service or still in civil life. This work will be simplified by the co-operation of the American Chemical Society which has something like eight thousand American chemists in its membership. When a bureau or staff needs chemists, requisitions will be made upon the head of the Chemical Service Section. Men will be moved as often as occasion may require, but will be kept permanently at chemical work.

Gas Attack

It has been announced from Washington, according to the New York daily papers, that the use of "gas" is to have increasingly important part in the war programme of the United States. It is stated that gas shells, until recently a minor part of the total shells manufactured, will in the near future form fifty to sixty per cent. of all shells turned out in American factories. Germany first experimented with gas projectors, which were found efficacious only when the wind was in the right direction. The enemy then hit upon the idea of enclosing the poisonous chemicals in explosive shells. This has proved a much greater success than the use of projectors, but the United States is employing both ideas and will use them to an extent Germany has found impossible.

Nitrogen for the Navy and Army

In the recently amended and passed "Naval Appropriation Bill" provision is made for "the erection, equipment and operation of a plant for the fixation of atmospheric nitrogen, production of synthetic ammonia, its oxidation to nitric acid, and the manufacture of ammonium nitrate." The appropriation for the plant, including every expense connected with running it, is $9,150,000. This plant is designed to serve the needs of the navy, and is quite distinct from the several plants of this kind being constructed for the army. The navy plant will be at Indian Head, Md., (near Washington, D.C.) and will use the Haber process. The chemists of the Bureau of Soils have developed the straight Haber process, as used in Germany, to such an extent that there is no doubt of its success in operation. The army plants at Sheffield, Tenn., use a modification of the Haber process for which the Government is indebted to the General Chemical Company.

In connection with the above notes, it is interesting to hear that a contract has been let for a third nitrogen fixation plant for the army. This is to be built as swiftly as possible. It will employ about 3,500 hands. It will be in two units, one near Cincinnati, O., and the other near Toledo, O. The Air Nitrates Corporation will erect the plant and operate it for the Government.

Wood Alcohol for War

The Government has begun building two large wood alcohol plants, one at Collingwood, Tenn., and one at Lyles, Tenn. At these points an abundance of cheap wood is available for alcohol manufacture. Alcohol being needed in such large amounts for explosives manufacture, as well as for other purposes in the war, considerable anxiety has been felt for some time about the adequacy of the supply. It is now hoped that the chain of plants, some owned by private capital, some under control of the British War Mission, and some by the American Government, will be able to produce a sufficiency.

Various Notes

The Security Cement and Lime Company, Hagerstown, Md. are operating a Cottrell precipitation process plant to obtain potash from cement dust which yields from two to three tons of potash daily. Three other plants, at least, are now recovering potash from their chimney dust. These are located in New York, Pennsylvania and California.

The summer meeting of the American Institute of Chemical Engineers took place at Gorham and Berlin, N.H., June 19-22. A large number of papers of importance were read and discussed. The chief feature of the meeting was the opportunity of inspecting the plants of the Brown companies under the leadership of Dr. Hugh K. Moore. This is one of the most diverse and remarkable chemical developments in America. Starting with pulp and paper as a base, a great chain of by-product industries have been developed, including substances as varied as chloroform, lard substitutes and hydrochloric acid.

The third trial of the suit between the Baugh Chemical Company and the Davison Chemical Company for $500,000 damages on account of failure of the latter to deliver the quantity of acid stipulated in a contract resulted in the jury returning a verdict for $139,433.65.

The Davison Company then carried the case from the Supreme Court to the Maryland Court of Appeals, the highest tribunal in the state, and on June 21st obtained a decision vacating the original injunction. While the verdict for damages still stands, it is the opinion of legal critics that the decision of the Court of Appeals indicates that an appeal in the case of the damage suit will result in a final victory for the Davison Company. The whole dispute hinged on the question as to whether a company having contracted to supply acid made from pyrites is obliged to supply acid made from brimstone, having exhausted all reasonable possible sources of supply of pyrites. The case has been followed with great interest by the chemical industry both on account of the prominence of the litigants and the interesting technical questions involved.

A picric acid plant costing $7,000,000 is being built near Brunswick, Ga. The plant is on the Southern Ry., Atlantic Coast Line Ry., and Atlanta, Birmingham and Atlantic Ry., and is also on tidewater. The plant will be operated by the Butterworth-Judson Corporation of New York. The plant will require six thousand men to operate it, and an extensive village is being built to house them. It is being built so as to be capable of conversion to other purposes after the war.

The Consumers' Dyewood Corporation is building a large plant at Mobile, Ala., to manufacture dye extract from logwood imported from Haiti. The plant will have 24 extractors of 30,000 gallons capacity each. It will produce 1,800 barrels of dye per month. Mr. G. A. LaVallee, of the Obex Dye Company, Marietta, O., is in charge of the new plant.

The Standard Sulphur Corporation, of Detroit, has built a large plant for producing sulphur near Orla, Texas. The daily output will be from 100 to 150 tons of refined sulphur. It controls about 5,000 acres of sulphur land.

There has been a good deal of excitement in chemical circles over disclosures made by certain politicians regarding the control of a number of the large American platinum concerns by German interests. The platinum companies in question have denied these charges, but the matter is under investigation, and some of the circumstances are decidedly suspicious. One of the principal men in the platinum industry is a German about whose loyalty there is reasonable doubt. There is great need for a vigorous campaign in the press and from public platforms to impress on the public the reasons for placing all available platinum in the hands of the Government. In spite of the great need for platinum in prosecuting the war the Fifth Avenue shops continue to fill their windows with platinum jewelry and women continue to wear platinum rings and other articles of adornment. A properly conducted campaign would make any woman of patriotic instincts ashamed to be seen wearing platinum until such time as the Government has announced that it has ample for war needs.

Proposed Government Standard for Gasoline

By Dr. A. McGill, Chief Chemist, Inland Revenue Department

From many sources, including Automobile Clubs, Farmers' Institutes and private individuals, this Department has, within the past year, received complaints as to the variable and unsatisfactory character of commercial gasoline, and has been petitioned to establish a standard of quality for the article.

Investigation of the matter proves that the charge of variability in quality of gasoline has a basis in fact. The greatly increased and constantly increasing demand for gasoline as a motor fuel has made it impossible to meet this demand by a straight distillate from the crude; and the gasoline of to-day is largely augmented by additions of so-called "cracked" products, and "casing-head" gasolines, as well as by addition of benzol.

Mixtures, of the kind indicated, furnish very efficient motor fuels, if the conditions requisite for their proper use are met; and if a mixture, of constant type, was available, motors could be so adjusted as to work satisfactorily with almost any such type. But analysis of brands of gasoline, sold under the same trade mark, indicate that constancy to type does not exist; and disappointment necessarily results when a fuel of variable character is used, without proper re-adjustment of the conditions under which it is used.

The manufacture of gasoline as a motor fuel is undergoing constant change; and it would be a great mistake to handicap manufacturers in their efforts to produce a cheaper and better motor fuel by legally establishing standards which would interfere with investigation of new or modified processes; and would compel methods now in use to remain unimproved and to become perpetual. This would be to stultify the industry.

It is, however, possible to standardize one type of motor gasoline in the sense of fixing constants for it, so that this particular brand shall have a constant character, and may therefore be guaranteed to work satisfactorily under conditions of use. This Department has decided to establish standards for such a gasoline, under the Adulteration Act.

It must be understood that Government standard gasoline does not claim to be a better motor fuel than other brands now on the market, or yet to be placed on the market. All of these brands, so far as investigation goes, possess value, and are capable of giving good results provided that the conditions under which they are employed, are properly met. And it is to be expected that, with increased experience in manufacture and improvement in manufacturing processes, the variability at present found to exist between different samples of the same brand, will disappear.

Government standard gasoline merely claims to be a type of motor fuel which can be depended upon to work satisfactorily in ordinary motor engines, and to be constant in character, so that the purchaser may be assured in this respect.

It is open to any manufacturer of gasoline to place Government standard gasoline on the market. In offering an article under this brand name, the manufacturer assumes responsibility, inasmuch as a penalty, under Section 39 of the Adulteration Act, attaches to failure to meet the specifications stated at length in Schedule 5 of the Act.

Schedule 5 of the Adulteration Act is amended by addition of the following:

Government Standard Gasoline

COLOR—Shall be approximately water-white.

ODOR—Shall be reasonably free from rank and unpleasant odors.

WATER—Shall be absolutely free from water.

SOLIDS.—Shall be absolutely free from suspended solid matters.

ACIDITY.—Shall be absolutely free from acid.

SULPHUR.—Shall be absolutely free from sulphur or sulphur compounds.

OLEFINES and other unsaturated compounds shall not exceed 12% by volume.

DENSITY shall be stated, either as specific gravity, or in degrees Beaume, at a stated temperature.

VOLATILITY—

(a) Initial boiling point shall lie between 40° and 60°C. (104° and 140° Fah.)

(b) Not over 10% volume shall distill below 60°C. (140°F.)

(c) At least 20% volume shall distil below 105°C. (221°F.)

(d) At least 50% volume shall distil below 140°C. (284°F.)

(e) At least 90% volume shall distil below 180°C. (356°F.)

(f) Dry point, not above 220°C. (428°F.)

RESIDUE—Not more than a trace of carbon.

Methods of Determining

Methods of working, for determination of above constants:

COLOR—Inspection of column in 4 oz. bottle.

ODOR—Spreading in thin film on clean glass surface, and noting odor.

WATER—Main sample to be thoroughly shaken and about 4 oz. to be poured into a clean glass cylinder or test tube. No separated water should appear after standing one hour.

SOLIDS—Test as above should show no separated or floating solids.

ACIDITY—25 c.c. (or 1 oz.) of the gasoline to be shaken thoroughly with 10 c.c. of distilled water. The aqueous extract must not color blue litmus paper pink.

SULPHUR—A clean silver coin (10 cent piece) must show no discoloration on being shaken with 25 c.c. of gasoline, and standing over night.

OLEFINES—Use Babcock cream test bottles (standardized) of 10 c.c. capacity. To 10 c.c. of the gasoline sample, add 20 c.c. of concentrated sulphuric acid (s.g. 1.84) and shake well for five minutes; add sufficient sulphuric acid to bring up the residual gasoline into the graduated stem. Allow to stand for twelve hours or spin in machine for ten minutes. Read residual gasoline on graduate stem, and calculate to loss of volume per cent.

DENSITY—Determine by Westphal balance, picnometer or hydrometer.

VOLATILITY—Work on 200 c.c. Use standardized apparatus, essentially as described by the American Society for Testing Materials. (See Technical Paper 166 of the Bureau of Mines, U.S.A.).

RESIDUE—By observation of residue in distilling flask.

Shawinigan Falls

(Correspondence of The Canadian Chemical Journal)

To see Shawinigan Falls is to realize the natural attractions which a great water power has for the chemical and metallurgical industries. There are over a dozen of these specialized plants in that city, and hardly a month goes by without the record of some new industry or an enlargement of one of the existing ones.

One of the notable new industries is the Canadian Ferro-Alloys, Limited. This company having decided to build their works here started on the first of May by clearing a site among the bushes. With all the handicaps implied in this, and with the further difficulties of shortage of labor, scarcity of materials and troubles in transportation, they have advanced so far with their work already that they expect to be in operation this month. The Canadian Ferro-Alloys will produce ferro-silicon in two grades—50% and 12½% and when fully working will make ferro-chrome, and probably at a later date tungsten. The first furnace to be put into operation will have a capacity of 17 tons per day, and the design of the plant provides for the operation of six furnaces of the same capacity. The development of the complete plant will probably cover a period of two years, and the works will then employ 400 men. These works are under the management of Mr. F. A. Raven, who, though a young man, has already made a reputation in this special line of metallurgy. He was superintendent of the United States Alloys Corporation of Buffalo, the largest of this class in America, except that of the Electro Metals Company of Welland. Of the seven ferro-solicon plants on this continent Mr. Raven has supervised the building of five and operated three. This new plant will be able to smelt anything in the mineral line, and Mr. Raven assured our correspondent that the Canadian Ferro-Alloys is not an industrial war-baby, but is designed to meet all the new conditions of peace production. To this end it will have a modern metallurgical laboratory.

Another new industry getting well on to completion is the Canadian Aloxite Company, which already has fourteen furnaces working under the management of Mr. E. B. Forse. An account of this new establishment has already appeared in THE CANADIAN CHEMICAL JOURNAL, but it may be mentioned that ground was broken last July, and furnaces were in operation in May. At these works fine abrasives will be made, the company being affiliated with the Carborundum Company, of Niagara Falls. When in full operation fourteen furnaces will be devoted to aloxite, and the plant will make 90% silicon metal. Provision is made for a large and well lighted laboratory which will be equipped at an early date. There are large deposits of silica of requisite richness within fifty miles of Shawinigan Falls, so that the location is favorable for raw materials as well as for power. The product is now being shipped to the United States. The company employ 150 hands.

Extensive additions have been in course of construction at the works of the Canada Carbide Company, under Mr. R. A. Witherspoon's superintendence. When these additions have been completed they will add 100 tons per day to the production of the works. This will mean that 100,000 horse power will be devoted to the manufacture of calcium carbide in Canada, making a production equal to that of the United States. As much of this in both countries is now converted into acetone and acetic acid for war purposes, it is questionable whether the supply for the trade for acetylene gas and other purposes, critically short for some time past, will be much alleviated by the new supply here referred to. The Canada Carbide Company are doing their best, consistent with their obligations to the Government to keep things going for the trade, but it is a difficult problem.

The Canadian Electrode Company, Limited, another new subsidiary of the Shawinigan Water & Power Company in the immediate vicinity of the carbide works have an extension under way. Most of the machinery is now on the ground and the works will be in operation next month.

Mr. G. H. Spencer is superintendent of these works, which will make electrodes for electric smelting ,etc., up to a size of 17 inches. When in full working the company will be able to produce 25 tons per day.

In September, 1915, Mr. H. W. Matheson, of the Du Pont Powder Co. was invited by the Shawinigan Water & Power Co. to take the chemical directorship of the Canadian Electro Products Co. here. At that time there was a great shortage of acetone, and the Imperial Munitions Board had asked the Shawinigan Company if they would not endeavor to work out a process for the commercial manufacture of this product from calcium carbide.

In November of the same year, he resigned from his position in the Research Department of the Du Pont Powder Company at Wilmington, to come to Shawinigan Falls and work on the development of this process. By May of 1916, sufficient work was done in order to warrant starting the design and construction of a large plant for the manufacture of acetone. In January, 1916, Mr. H. S. Reid was engaged as assistant on this development work.

In May, 1916, the Canadian Electro Products Company was organized, in order to carry on the construction and operation of this process.

In May, 1917, a contract was entered into with the Imperial Munitions Board, by which they agreed to take the total output of the plant, for a period of one year after the starting of operations. Beyond this, the Imperial Munitions Board have had no interest whatever, either in the experimental work, design of the new plant, or the construction and operation of the same, nor have the Imperial Munitions Board given any financial aid to the Shawinigan Water & Power Company to carry on this work.

In May, 1916, Dr. John S. Bates was appointed by the Imperial Munitions Board as an inspector for them. This work covered inspection of construction and the inspection of the finished product, namely, acetone and acetic acid, in which capacity Dr. Bates has been and still is engaged.

With reference to the process itself, this consists of:

1. The manufacture of acetaldehyde from acetylene in presence of sulphuric acid and mercury.
2. The catalytic oxidization of the acetaldehyde to acetic acid.
3. The catalytic decomposition of glacial acetic acid into acetone water and carbon dioxide.

At present they are not manufacturing acetone for the Imperial Munitions Board, but are selling the Board glacial acetic acid, this product being used in the manufacture of cellulose acetate, which product in turn is used in the coating of aeroplane wings.

There is much building activity in Shawinigan Falls and the population is now estimated at 14,000, the various works employing between 3,600 and 4,000 hands.

It is understood that the Shawinigan Water & Power Company will give to the world some evidence of the marvelous developments here by making an exhibit of the products of its subsidiary companies at the National Exposition of Chemical Industries in New York in September.

At an early date it is hoped that THE CANADIAN CHEMICAL JOURNAL will be able to give a more comprehensive account of the industries which are fast taking up the 300,000 horse power available in this region.

Electric Low Phosphorus Pig Iron

By D. E. Armstrong

On account of the severe shortage of low phosphorus pig iron in Canada, and the inability to get export licenses from the United States Government, the Canadian steel makers (acid open hearth practice) had to manufacture a pig iron suitable for their requirements. As there is an enormous demand for acid steel, the manufacturers were obliged to experiment with an electric furance to produce this much needed iron.

Early in 1917, the William Kennedy & Sons, Limited, Collingwood, Ont., installed an electric furance at that point. This furnace is used exclusively in producing a portion of the iron required in the manufacture of steel for the Imperial Munitions Board. As the specifications for shell steel call for low phosphorous and low sulphur contents, it is possible to manufacture this iron from shell steel turnings and shell steel scrap. By employing a basic slag and careful manipulation of the slag in the furnace it is possible to reduce a certain amount of the sulphur in the scrap. The Kennedy furnace is of the stationary type, and has a capacity of three tons, or of twelve to fifteen tons output per day, with a power consumption of 600 to 750 kilowatts. The power used is 3-phase, 60 cycle alt. current and transformed from 2,200 to 80 volts which is the voltage used. The walls and roof of the furnace are made of silica brick, the average life being from 250 to 300 heats.

The bottom is made of fire clay over which is a base of special construction being lime and dead burned magnesite sintered together in right proportions. The heat is generated through 17 inch round carbon electrodes. In the furance roof are water-cooled roof-rings, through which the electrodes enter the furnace. They are held in place by water cooled electrode holders. This cooling arrangement prolongs the life of both the roof and the electrodes. The furnace is controlled by automatic specially designed regulators, which enabled a much more steady load than hand manipulation. Besides the regulators the electrodes are lowered and raised by electrically controlled winches which eliminate a considerable amount of manual labor.

The charge consists of shell steel turnings; charcoal, and petroleum coke, or anthracite coal; ferro silicon; and lime. Care is taken in the process to conserve the manganese in the scrap, and it is not necessary to add a further supply in the bath. It has been demonstrated by the Kennedy furnace that the sulphur content was very irregular when additions were made of coke or anthracite coal to increase the carbons, and in order to get fairly accurate and regular product it was necessary to use charcoal. This is due to the small amount of sulphur contained therein. The pig iron is cast into cast iron moulds and the pigs weigh about 200 pounds.

The return in pig iron in comparison with the weight of scrap and ferro silicon charged is about 90% and the balance 10% being lost in the slag and gasses. The carbon contents will average about 3.60% as will be noticed from table of analysis of several consecutive heats.

Heat No.	c.	si.	s.	p.	mn.
705	3.51	.75	.015	.032	.55
706	3.76	.86	.015	.033	.57
707	3.56	1.31	.014	.031	.58
708	3.21	1.51	.016	.036	.56
709	3.32	1.06	.010	.030	.50
710	3.77	1.40	.010	.032	.54
711	4.15	1.26	.009	.030	.55
712	3.61	1.25	.010	.031	.53
713	3.45	1.31	.009	.029	.50

The Solvay Process Company of Syracuse, N.Y., on whose chemical processes the new works of the Brunner-Mond Company of Canada, at Amherstburg, are based, suffered from two explosions on the 2nd inst. The explosions were the result of a fire that got beyond control and spread to the T.N.T. vats. The works are at Split Rock outside the city. A shift of five hundred men who were on the ground when the fire started, tried to put out the flames, but were caught by the first explosion. Men and fragments of buildings were scattered in every direction, and at date of writing forty-five dead bodies were found and two hundred injured persons removed from the wreckage. The cause of the fire had not been learned.

On the same date a report came of a disastrous explosion in one of the national shell filling works in the Midlands, England, as the result of which between sixty and seventy people were killed. A considerable part of the factory was saved.

Personal

Mr. John V. Galley, of Montreal, Que., has moved to Pakenham, Ont.

Mr. J. A. DeCew, chemical engineer, Montreal, is spending his summer holiday in Saskatchewan.

Mr. Eugene Poitevin, B.Sc., one of the Dominion mineralogists, is now investigating the platinum resources of British Columbia.

Mr. M. J. Marshall, late demonstrator in chemistry, McGill University, is now research chemist at the Canadian Electro Products Company, Shawinigan Falls, Que.

Mr. Edw. A. Dore, chief chemist at the Bathurst Lumber Company's paper mill at Bathurst, N.B., has been called by the draft to the United States Army, joining the forces in Maine.

Dr. H. M. Auri, for some thirty years on the Geological Survey staff at Ottawa, is at present in charge of "war metals and minerals" at the British Embassy, Washington, D.C.

Mr. D. U. Hill, of Wolfville, N.S., has joined the staff of the Hercules Powder Company, of Kenville, N.J., and will remain there until October.

Mr. Charles Camsell, B.Sc., has been placed in charge of the new branch of the Geological Survey, recently established in British Columbia. The office is in Vancouver and it is intended that the branch will be permanent.

Mr. L. E. Westman, of the Inland Revenue Laboratories, Ottawa, has been appointed assistant in chemistry in the University of Toronto, and Mr. J. W. Morgan, chemist at the Atlantic sugar refinery, has been appointed demonstrator in electro chemistry at the same university.

Mr. E. H. Hamilton, who for some time has been metallurgical manager for the Consolidated Mining and Smelting Company of Canada, at its smelting works at Trail, B.C., has taken a position with the United States Smelting Company at Midvale, Utah.

Dr. Alfred Stansfield, of Montreal, has accepted a commission acting on behalf of the British Columbia Government, to investigate the commercial possibilities of applying electrical smelting methods to the development of the iron ore resources of the province. Dr. Stansfield was expected to reach Victoria, B.C., about the middle of June.

Mr. D. McLaren, having just completed his post graduate work in organic chemistry at the University of Chicago, has returned to Canada and has joined Gunns Limited, Toronto, where he will take up investigations in fertilizers. Mr. McLaren is a native of Ontario. He graduated at the University of Toronto, and was for a time in the laboratories of the Department of Agriculture, Ottawa.

Dr. J. C. Olsen, for years on the staff of the Cooper Union, New York, and more widely known as the secretary of the American Institute of Chemical Engineers, has been appointed professor of chemical engineering and head of the department of chemistry at the Polytechnic Institute of Brooklyn. The Institute has acquired the building formerly used by the Preparatory Department, which gives opportunity for expansion and reorganization of the chemical engineering and other departments. A new chemical engineering laboratory will be equipped for use this fall, by the greatly enlarged classes in chemical engineering.

Chemical and Metal Markets

The Quotations below represent average prices for the quantities indicated. Larger quantities may be obtained at lower figures.

Toronto, July 4, 1918.

The feature of the chemical and metal market is the general firmness of prices, due in great part to the natural effect of the tightening restrictions upon imports from the United States as well as from Great Britain. Wherever materials are required for war the industries engaged on war work have the first consideration, and this consideration governs the market in all industries.

Ammonia and its compounds and potassium in its various forms are high in price and increasingly scarce for the reason above given. As an illustration of the difficulty of getting supplies from overseas one Canadian firm ordered a consignment of nitrate of potash in May, 1917, but it was not delivered till May of this year, by which time the requisition had been dropped from the records. One exception to this restriction appears to be carbolic acid, which has recently been coming from England in quantities sufficient to cause an easing of prices.

Speaking of imports the chemical trades have been looking with some hope to Japan as a source of relief from the present unprecedented embarrassment. Castor oil, which has become so scarce because of its extensive use as an aeroplane lubricant, is now being produced in Japan and the sample lots brought to Canada are highly satisfactory. The same may be said of quinine and iodide of potassium, both made in Japan—the latter of kelp from the seaweeds of the Japanese coasts. It is the opinion of a chemist well qualified to judge, that these Japanese products have proved to be of such a standard as to anticipate that in many lines of fine chemicals Japanese manufacturers will be able to hold their own with those of Germany even if no discriminatory duties were levied in favor of the oriental makers.

Government control of home production of what may be called war chemicals, such as sulphuric acid, acetic acid, etc., is taken for granted in Canada, but civil trade has been interfered with as little as possible. Events may arise which would extend this control to more definite supervision of the output during the war.

Chloride of lime and hyposulphite of soda are now more difficult to obtain from the United States markets, no doubt because of their extensive use for gas attack material.

Iron, steel and almost all metals are firm in price, and imports of such materials as steel plate, etc., from the United States are more and more restricted as work increases on war equipment. The United States government has increased the official price of copper to 26 cents.

Acetanilid, C.P.	Lb.	1 10—1.20
Acetic acid, commercial, crude, 28%, in bbls.	Lb.	10⅛—10⅜
" " 80 per cent. pure	Lb.	.35—.37
Acetone	Lb.	.55— 56
Alcohol. grain, bbl	Gal.	8.50
Alcohol, methylated, .bbl	Gal.	1.65
Alcohol, wood, 95 per cent., refined bbl.	Gal.	1.60
Alum, ammonia lump	100 Lbs.	$6.00—6.50
Aluminum Sulphate, high grade, bags.	100 Lbs.	3.50—4.00
Ammonia, Aqua .880	Lb.	.16—.18
Ammonium Carbonate	Lb.	.16—20
Benzoic Acid	Lb.	5.50—6.00
Bleaching Powder, 35% drums	100 Lbs.	3.50
Borax, crystals	Lb.	.10—.10¼
Boric Acid, powdered	Lb.	.17
Calcium Chloride, fused, in drums	Lb.	.2½
Carbolic Acid, white crystals	Lb.	.85—.90
Carbon Bisulphide	Lb.	.15—.20
Caustic Soda, ground, Bbl.	Lb.	.08—.10
China Clay, imported	per ton	$25—$30
Chloroform, com	Lb.	.75—.90
Citric Acid, domestic, crystals	Lb	1.10—1.15
Cobalt Oxide, black	Lb.	1.50—1.75
Copper Sulphate (Blue Vitriol)	Lb.	.11—.12¼
Fuller's Earth, powdered	100 Lbs.	6.00
Glycerine, 56 lb. tin	Lb.	80
Hydrochloric Acid, carboys, 18°	Lb.	.03¼—.03½
Lead Acetate, white crystals	Lb.	.25
Lead Nitrate	Lb.	.18—.20
Magnesium Carbonate, B.P., bbl	Lb.	.18—.20
Nitric Acid, 36° carboys	100 Lbs.	9¼—9¾
Oxalic Acid	Lb.	.55
Phosphoric Acid, S.G. 1750	Lb.	.75
Potassium Bromide	Lb.	2.00—2.25
Potassium Carbonate 90 to 95%	Lb.	.85—95
Potassium Chlorate, crystals, Kegs	Lb.	.55—.60
Potassium Nitrate......, Kegs		(Nominal)
Potassium Permanganate, bulk	Lb.	4.00
Salicylic Acid	Lb.	1.25—1.50
Silver Nitrate	Oz.	.90—.95
Soda Ash, bags	Lb.	.03½—.04
Sodium Acetate	Lb.	.20—.22
Sodium Bicarbonate, 100% pure	100 Lbs.	3.75—4.00
Sodium Bichromate, bbls,	Lb.	.24—.25
Sodium Cyanide, bulk, 98-99 per cent, in cases	Lb.	.38—.40
Sodium Hyposulphite, kegs	100 Lbs.	3.60—4.00
Sodium Nitrate, refined	100 Lbs.	8.50—9.00
Sodium Silicate, according to density	100 Lbs.	4.00—5.00
Sulphur, ground	100 Lbs.	3.00—3.50
Sulphur, roll	100 Lbs.	4.75—5.50
Sulphuric Acid, 66°Be, carboys	100 Lbs.	3.25—3.75
Tannic Acid, commercial	Lb.	1.90
Tartaric Acid, crystals or powdered	Lb.	.95—1.00
Tin Chloride, crystals		(Nominal)
Zinc Sulphate, com	Lb.	.6½—7.00

Metals

Aluminum, No. 1, 98-99% ....base price	Lb.	.40—.50
" Government price in 50 ton lots		.33
Antimony	Lb.	.14—.16
Arsenic, white	Lb.	.15—.17
Brass, yellow ingots	Lb.	.20—.22
" red	Lb.	.27
Cobalt, metal	Lb.	2.25
Cobalt oxide, grey	Lb.	1.65
Copper, casting	Lb.	.29
Copper, electrolytic	Lb.	.30
" Am. Government price (electrolytic and casting	Lb.	.26
Iron, bars	100 Lbs	5.25
Lead	Lb.	.10—.10¼
Magnesium	Lb.	2.75
Mercury	Lb.	3.00—4.00
Nickel, electrolytic	Lb.	.45—.50
Platinum, pure	Oz.	105.00
Silver, bar (New York prices)	Oz.	.99½
Spelter	Lb.	.10—.10½
Steel, mild	100 Lbs	5.25
" nickel, in bars, 3½% Nickel	Lb.	.25—.27
" sheet, Bessemer, 28 gauge	100 Lbs.	8.00—8.30
Tin	Lb.	1.25

Sulphur Statistics

We have received from Parsons & Petit, 63 Beaver Street, New York, a wall card, in sulphur color, on sulphur statistics. It gives the United States production and the imports and exports of the United States and other principal countries; and similar returns regarding pyrites and sulphuric acid. The statistics include the trade returns from 1912 year by year to as recent a date as obtainable. These show that the production of sulphur in the United States has grown from 303,472 tons in 1912 to 1,200,000 tons in 1917 and an estimated production of 1,500,000 tons in 1918.

British Trade Commissioner for Ontario

Mr. Fred. W. Field, the newly-appointed British Trade Commissioner for Ontario, has opened offices in the Confederation Life Building, Toronto, and is now organizing his work of developing trade between Great Britain and the Province of Ontario. Mr. Field will be glad to get into touch with commission merchants or manufacturers who wish to obtain Ontario agencies of British firms either now or after the war. He will be glad to discuss with them and others interested the encouragement of British trade with this part of Canada, and will be glad to have samples of German or Austrian merchandise showing the class of goods required for this market. There is no doubt many new lines of goods will now find a market in Ontario, while many articles of Canadian manufacture will have a market in Great Britain or for export to other countries, as well as for home consumption. Mr. Field will be at the service of any reliable firm wishing to develop new trade.

CLASSIFIED INDEX OF ADVERTISEMENTS

Acetone and Acetates—
Standard Chemical Co.

Acids—
Dominion Tar and Chemical Co.
Merck & Co.
Standard Chemical Co.
Mallinckrodt Chemical Works
McArthur Irwin Limited
Nichols Chemical Co.
The Topley Co.
J. C. Brown, Inc.
Caravel Company, Inc.
Levinstein Limited
U.S. Varnish Co.

Acid-proof Paints—(See Paints)

Acid-proof Pipes and Tubes—
Maurice A. Knight
United Lined Tube & Valve Co.
U. S. Stoneware Co.

Air Compressors—
Canadian Ingersoll Rand Co.

Alcohol, Wood—
Standard Chemical Co.

Alum—
A. M. Huestis.
Nichols Chemical Co., Ltd.

Architects—
Samuel M. Green Co.

Arsenic—
Coniagas Reduction Co.
Deloro Smelting & Refining Co.

Autoclaves—
Valley Iron Works.
Lymans, Limited.
Scientific Materials Co.
Ernest Scott & Co.
The Topley Co.
Detroit Heating & Lighting Co.

Babbitt Metal—
Canadian Fairbanks-Morse Co.

Barrels—
W. D. Beath & Sons, Limited
Charles Mueller Co, Limited
Smart-Turner Machine Co.

Bismuth, Metal and Salts—
Merck & Co.

Bleaching Powder—
Canadian Salt Co.
T. E. O'Reilly.
Nichols Chemical Co., Ltd.
Wilson Paterson Co.
A. Mendleson's Sons.

Bunsen Burners—
Detroit Heating & Lighting Co.

Carbide—
Canada Carbide Co.

Carbonic Acid Gas—
Canadian Carbonate Co., Ltd.

Caustic Soda—
J. C. Brown, Inc.
Canadian Salt Co.
Mendleson, A's Sons.
Wilson Paterson Co.
Merck & Co.
Nichols Chemical Co.
Canadian Anilines & Chemicals Ltd.

Caustic Soda Plant—
The Dorr Company

Chemical and Consulting Engineers
The Dorr Company
Buffalo Foundry & Machine Co.
Donald, J. T. & Co.
Dorr Company
Ernest Scott & Co.
Fitzgerald Laboratories.
Gilbert Laboratories
Stillwell Laboratories.
Associated Geological Engineers.
Process Engineers, Limited
Palo Company
Samuel M. Green Co.
Toronto Testing Laboratory
James, Loudon and Hertzberg.
George Taylor Hardware Ltd.
Ruggles-Coles Engineering Co.
E. J. Young

Cobalt—
Coniagas Reduction Co
Deloro Smelting & Refining Co.
Keeling & Walker, Ltd.

CLASSIFIED INDEX OF ADVERTISEMENTS—*Continued*

Chemicals—
Acme Laboratories
Kalbfleisch Corporation.
Mallinckrodt Chemical Works
Wm. H. Scheel.
Geigy Company Inc.
Huestis. A. M.
Lymans, Limited.
Keeling & Walker, Limited
Mendleson A's Sons.
Chalmers, R. S. & Co.
The Topley Co.
J. C. Brown, Inc.
Caravel Company, Inc.
W. A. Pye Co.
Levinstein Limited
Lazard-Godchaux of Am., Inc.
Hellenic Chemical & Color Co,
McArthur, Irwin, Ltd.
O'Reilly, T. E.
Palo Company
Standard Chemical Co.
Canadian Anilines & Chemicals Ltd.
Nichols Chemical Co.
Monsanto Chemical Works.
A. Daigger & Co.
Dominion Tar & Chemical Co.
The J. F. Hartz Co., Limited

Colors—(See Dyestuffs)

Condensers—
Detroit Heating & Lighting Co.

Copper Coils—
Detroit Heating & Lighting Co.

Drills, Rock—
Canadian Ingersoll-Rand Co.

Compressors—(See Air Compressors)

Exposition—
National Exposition Chem. Industries

Drills, Twist—
Pratt & Whitney Co. of Canada

Drugs—
J. C. Brown, Inc.
Caravel Company, Inc.
Levinstein Limited
Monsanto Chemical Works
O'Reilly, T. E.
Scheel, Wm. H.
Merck & Co.
Lymans, Limited
Mallinckrodt Chemical Works

Drums—(See Barrels)

Dryers—
Ernest Scott & Co.
General Ceramics Co.
Ruggles-Coles Engineering Co.
J. Harrison Carter, Ltd.

Dyestuffs—
T. D. Wardlaw.
Chalmers, R. S. & Co.
T. E. O'Reilly.
Lazard-Godchaux Co. of Am., Inc.
Wilson, Paterson Co.
Standard Chemical Co
Geigy Company, Inc.
Merck & Co.
Canadian Anilines & Chemicals Ltd.
Hellenic Chemical & Color Co.
McArthur, Irwin, Ltd.
Levinstein Limited

Electrical Apparatus—
Nichols Chemical Co., Ltd.
Canadian General Electric Co.
Canadian Hoskins Limited
Volta Manufacturing Co.
Samuel M. Green Co.
Canadian Fairbanks-Morse Co.

Enameled Steel Tanks and Apparatus
The Pfaudler Co.

Engineers—(See Consulting Engineers)

Engines—
Canadian Fairbanks-Morse Co.

Evaporators—
Valley Iron Works
Ernest Scott & Co.

Filter Paper—
Angel, H. Reeve and Co.
Lymans, Limited.
Scientific Materials Co.
A. Daigger & Co.
Eimer & Amend.
The J. F. Hartz Co., Limited.
Palo Company
The Topley Co.
George Taylor Hardware Ltd.
W. A. Pye Co.

Filtering Equipment—
United Filters Corp.

Fertilizers—
O'Reilly, T. E.

Furnaces and Accessories—
Canadian Hoskins Limited
Volta Manufacturing Co.
Scientific Materials Co.
Samuel M. Green Co.
George Taylor Hardware Ltd.

Gas Machines—
Detroit Heating & Lighting Co.
Canadian Hoskins Limited

Geologists—
Associated Geological Engineers
E. J. Young
Gilbert Laboratories

Grinding Machines
J. Harrison Carter, Ltd.
Canadian Fairbanks-Morse Co.

Glassware, Chemical—
Lymans, Limited.
Scientific Materials Co.
A. Daigger & Co.
Eimer & Amend.
Palo Company
The Topley Co.
The J. F. Hartz Co., Limited
Griebel Instrument Co.
W. A. Pye Co.

Iodine Preparations—
Merck & Co.

Kegs—(See Barrels)

Kettles—
Detroit Heating & Lighting Co.
Pfaudler Co.

Laboratory Apparatus and Supplies—
Lymans, Limited.
Scientific Materials Co.
H. Reeve Angel & Co.
A. Daigger & Co.
Valley Iron Works.
Eimer & Amend
Detroit Heating & Lighting Co.
Palo Company
The Topley Co.
The J. F. Hartz Co., Limited
Griebel Instrument Co.
George Taylor Hardware Ltd.
W. A. Pye Co.

Machine Tools—
John Bertram & Sons Co., Limited
Pratt & Whitney Co. of Canada

Magnesium—
Shawinigan Electro Metals Co.

Microscopes—
The J. F. Hartz Co., Limited
The Topley Co.
W. A. Pye Co.

Nickel—
Coniagas Reduction Co.
Deloro Smelting & Refining Co.

Oils—
J. C. Brown, Inc.
Standard Chemical Co.
Canadian Anilines & Chemicals Ltd
Dominion Tar and Chemical Co.

Paints
McArthur, Irwin, Ltd.
Hellenic Chemical & Color Co.
U. S. Varnish Co.

Patent Solicitors—
Ridout & Maybee
Hanbury A. Budden

Pipes—
Canadian Fairbanks-Morse Co.
United Lined Tube & Valve Co.

Platinum Ware—
Lymans, Limited.
The Topley Co.
Scientific Materials Co.
Eimer & Amend.
Griebel Instrument Co.
Palo Company

Photographic Chemicals—
Merck & Co.
Mallinckrodt Chemical Works
The Topley Co.
Levinstein Limited

Pumps—
Canadian Allis-Chalmers
Canadian Ingersoll-Rand Co.
Canadian Fairbanks Morse Co.
Smart-Turner Machine Co.
United Lined Tube & Valve Co.

Rails—
John J. Gartshore

Refiners—
Coniagas Reduction Co.
Deloro Smelting & Refining Co.

Rhotanium—
Palo Company

Stains—
The J. F. Hartz Co., Limited
Dominion Tar & Chemical Co.
The Topley Co.

Steam Turbines—
Canadian General Electric Co.

Still—
Detroit Heating & Lighting Co.

Stoneware, Chemical—
General Ceramics Co.
Maurice A. Knight.
U. S. Stoneware Co.

Sulphur—
Union Sulphur Co.

Tanks and Tank Equipment—
W. D. Beath & Son, Limited
Buffalo Foundry & Machine Co.
The Pfaudler Co.
Goold, Shapley & Muir Co., Limited

Tar—
Dominion Tar & Chemical Co.

Tools, Small
Pratt & Whitney Co. of Canada

Valves—
Canadian Fairbanks-Morse Co.
United Lined Tube & Valve Co.

Varnishes—
Dominion Tar & Chemical Co.
McArthur, Irwin, Ltd.
U. S. Varnish Co.

Wood Tanks—(See Tanks)

Zinc Products—
Metals Disintegrating Co.
Keeling & Walker, Limited

Index of Advertisements

EMPLOYMENT DEPARTMENT

The charge for condensed advertisements of "Engagements Wanted," or "Positions Open," is 50 cents per month for advertisements of 40 words or less, no charge being made for the use of box numbers in care of CANADIAN CHEMICAL JOURNAL.

ENGAGEMENTS WANTED

Chemist, B.Sc., Canadian, 27, desires change. Research experience in metallurgy and organic chemistry. Experience in metallography, micro-photography, organic analysis, testing of lubricants; liquid, gaseous and solid fuels; analysis of ores and non-fereous alloys. Salary must be attractive. Apply Box 12, CANADIAN CHEMICAL JOURNAL.

CHEMIST, familiar with gun-cotton, powder, TNT, nitric and sulphuric acids. Experienced in analysis of acids. Capable manager. Box 5, CANADIAN CHEMICAL JOURNAL.

POSITION wanted by an analytical chemist, University Graduate in Chemistry. One year's experience in large laboratory. First-class references. Apply Box 2, CANADIAN CHEMICAL JOURNAL.

Graduate chemist, experienced in steel, explosives and organic research, desires change. Good organizer and efficient manager. Apply Box 19, THE CANADIAN CHEMICAL JOURNAL.

A young engineering student desires a position in a chemical laboratory. Complete high school education as well as two years at Toronto University in the department of chemical engineering.—Box 16, CANADIAN CHEMICAL JOURNAL.

POSITIONS OPEN

Industrial concern located three hours from large city, wants immediately a young graduate chemist (man or woman) for analytical work. Must have good experience in routine analysis. Application forwarded to Box 14, THE CANADIAN CHEMICAL JOURNAL. State salary wanted.

CHEMISTS FOR MUNITIONS WORK

The Imperial Ministry of Munitions require the services of Analytical Chemists who are ineligible for Military Service, or who are not in the first class. Applications from ladies with a knowledge of Chemistry will be considered.

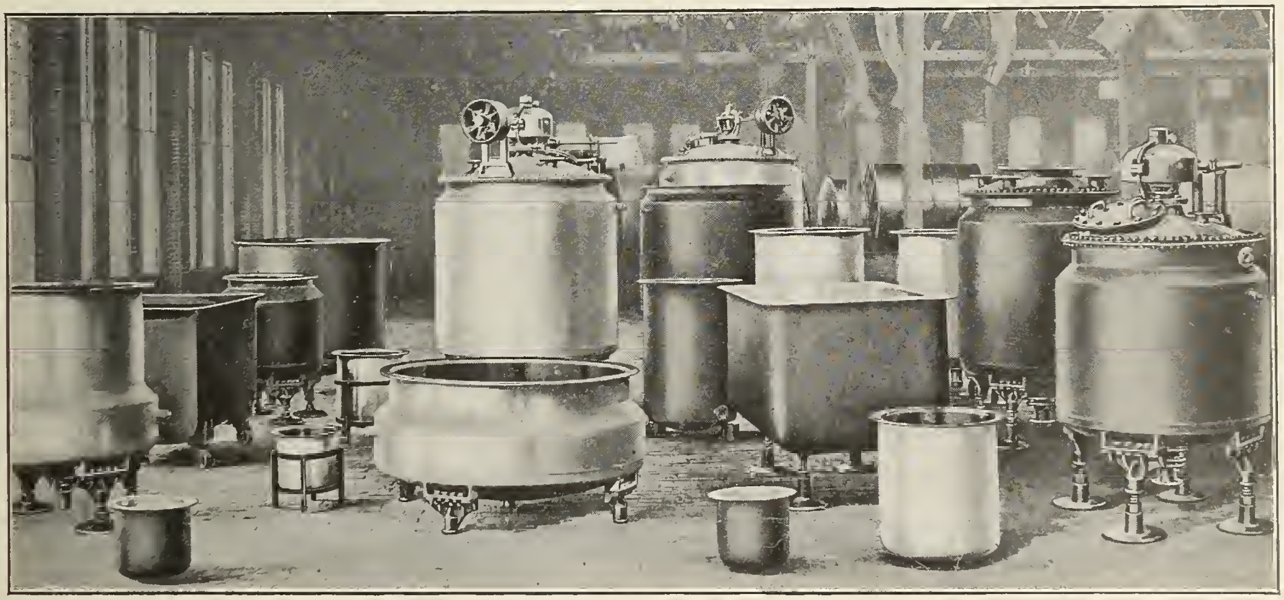
Apply to THE DIRECTOR OF INSPECTION, Imperial Ministry of Munitions, OTTAWA

MACHINERY WANTED

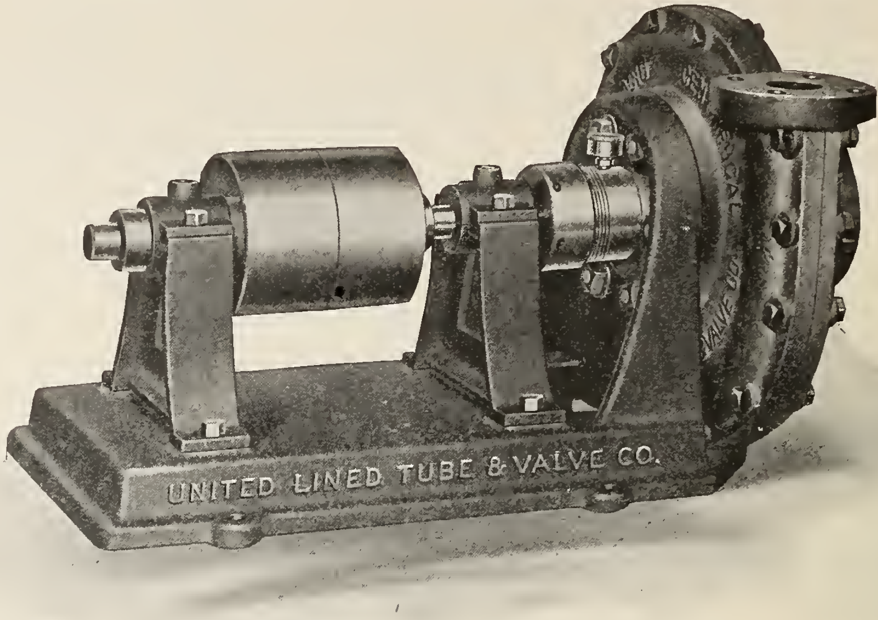
The advertiser wishes to get in touch with makers of plant for the production of Hydroflouric Acid. Address Box No. 1, CANADIAN CHEMICAL JOURNAL.

Process Foreman in T.N.T. Explosives or Acid mannfacture who desires to connect with a related industry which manufactures a commercial product can communicate with Box 17, CANADIAN CHEMICAL JOURNAL.

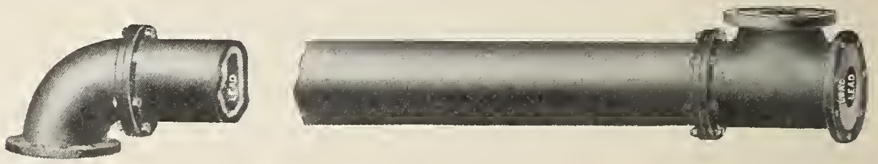
Large chemical works requires the services of several chemical Foremen who offer experience in some branch of process work. Must be accustomed to handling men. Good prospects in a permanent industry. State salary wanted and particulars on work you have engaged in. Box 18, CANADIAN CHEMICAL JOURNAL.



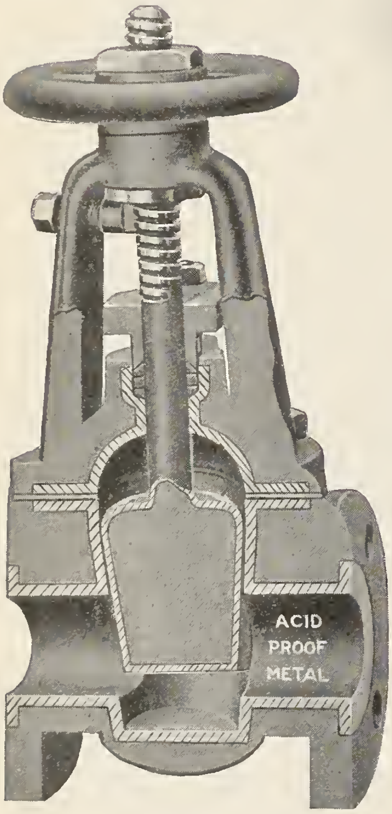
Acid-Proof Pump, Pipe Fittings and Valves



Centrifugal Acid Pump



Section Flanged Pipe and Fittings



Gate Valve

Hard Lead Stop

Hard Lead Bibb

Lead Lined Expansion Bend

These illustrations represent only a few of the varied line of products manufactured by the United Lined Tube & Valve Company of Boston, Mass., for handling Acid and Corrosive Chemicals. Our products are installed in many of the largest Chemical Plants in the United States.

Catalog upon application.

Canadian Representative : HOYT METAL CO., TORONTO

SELLING AGENTS IN UNITED STATES:

United Lead Co., 111 Broadway, N. Y.

Gibson & Price Co., Cleveland, Ohio

Raymond Lead Co., Chicago, Ill.

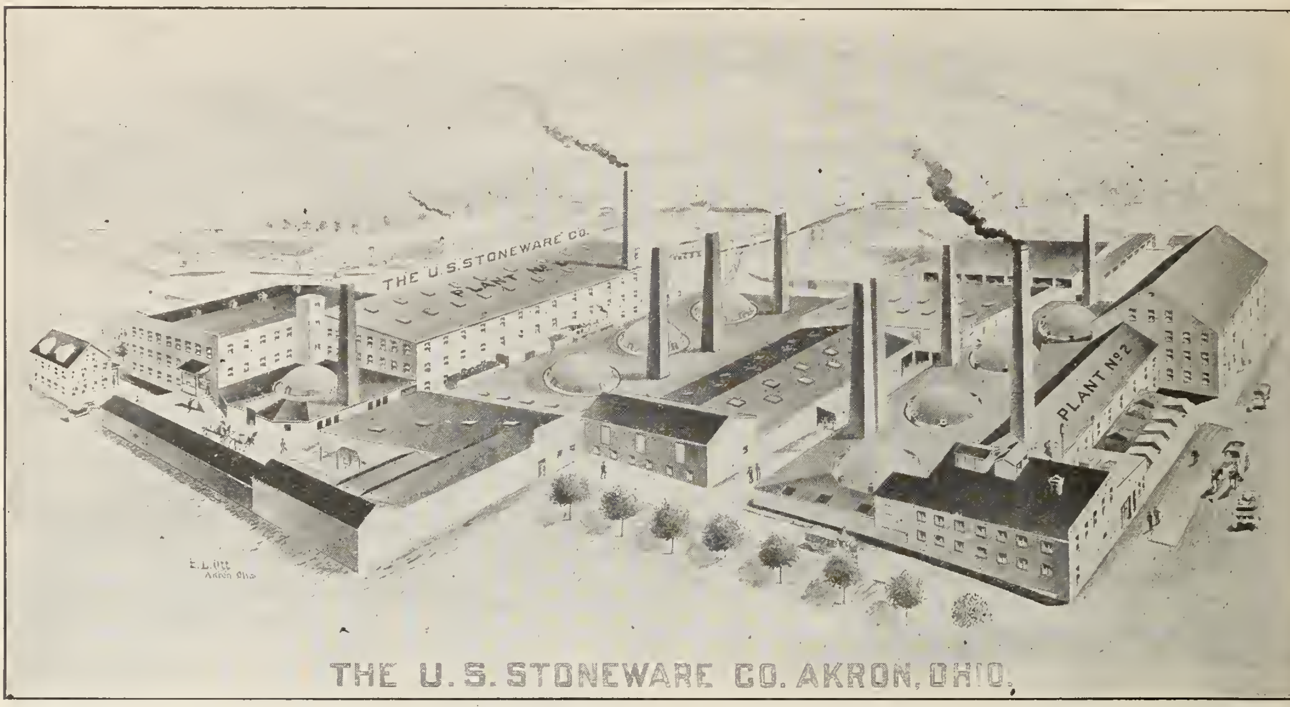
Jas. Robertson Lead Co., Baltimore, Md.

Tatham & Bros. Works, Philadelphia, Pa.

Hoyt Metal Co., St. Louis, Mo.

Chadwick-Boston Lead Co., Boston, Mass.

"The celebrated impervious body of the U.S. Stonewore Co.'s Stoneware is due to the exclusive clay of which it is made."



Largest Chemical Stoneware Plant in the United States. This Mammoth Plant is the result of QUALITY.

Acid-proof Chemical Stoneware

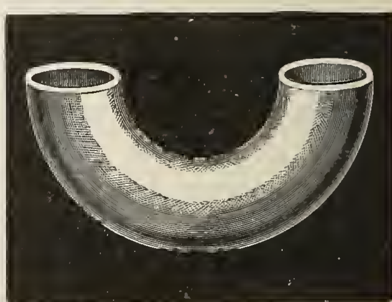
There is nothing so sensitive in a business way as one's bank account—isn't that true?

That it is easy to spend money without getting the best results is also true. Especially is this true when purchasing Chemical Stoneware.

If, however, you require chemical apparatus and place your orders for Acid-proof Stoneware with the United States Stoneware Company you will eliminate a loss which you may now be sustaining because their Stoneware lasts longer, gives most lasting service and thus increases your bank account.

Our elabo te catalog will aid you in selecting.

Everything in Stoneware and bricks.



The United States Stoneware Company

ESTABLISHED 1865

AKRON, OHIO, U. S. A.

U S STANDARD THE U.S. STONEWARE CO. AKRON. OHIO.

Factory No. 1: 160 to 172 Annadale Ave.
Factory No. 2: 221 to 273 Fountain St.

CANADIAN CHEMICAL JOURNAL

A Canadian Journal devoted to Metallurgy
Electro-Chemistry and Industrial Chemistry.

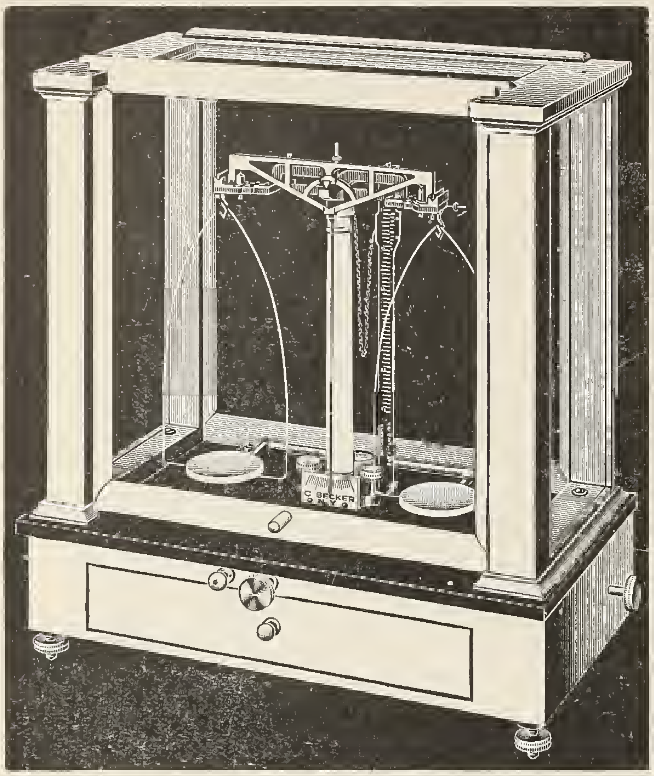
Vol. II, No. 8 | TORONTO, AUGUST, 1918 | 20c. a copy; $2 a year

PROFESSIONAL DIRECTORY


MOST IMPORTANT EVENT OF THE YEAR
GRAND CENTRAL PALACE
NEW YORK
WEEK OF SEPT. 23 -1918-
FOURTH
EXPOSITION CHEMICAL INDUSTRIES
For further particulars, address
National Exposition Chemical Industries, Grand Central Palace, New York

ANALYTICAL CHAIN BALANCE

INVALUABLE FOR RAPID WORK



The **chain balance** is of the usual construction of analytical balances, with the exception that there is no rider and consequently no graduations on the beam. All weighing below 50 m.g. to 1/10 m.g. is accomplished by lifting or lowering a small gold chain, suspended at one end from the beam, and at the other from a sliding hook attached to the graduated scale, from which direct readings are taken To operate it is only necessary to rotate the thumb screw, conveniently placed outside the balance case, on the right hand side. (See illustration). This operation can take place while the beam is swinging, this in conjunction with the **elimination of all riders, and small weights below 50 m.g., resulting in a great saving of time.**

ANALYTICAL CHAIN BALANCE No. 15
With Vernier

Capacity	100 grams
Sensitiveness	1/20 milligram
Diameter of Pans	3 inches
Length of Beam	6 inches
Bearings	Agate
Knife edges	Agate
Capacity of bar and vernier	50 Mg. to 1/10 Mgm.

Polished mahogany case, front sliding frame, counterpoised. Mounted on black plate glass.

Price (Duty Free)................ **$130.00**
" (Duty Paid)................ **175.00**

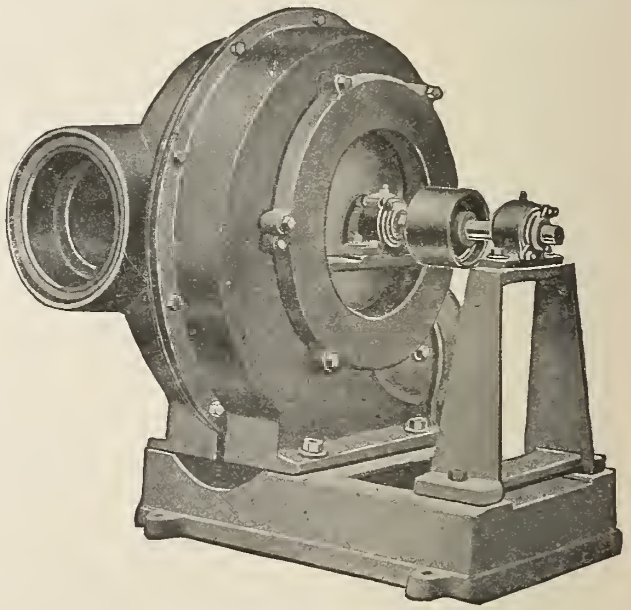
Above prices subject to advance without notice.

SALES AGENTS

LYMANS, LIMITED

344 St. Paul St. West MONTREAL

CHEMICAL STONEWARE



Exhauster Series No. 100

Acid Proof Apparatus and Machinery known all over the world for excellence of material and workmanship.

FOR HANDLING ACIDS AND OTHER CORROSIVE MATERIALS

The Best is none too Good

GENERAL CERAMICS CO

Plants at Keasbey, N.J. **Offices: 50 Church St., New York**

CANADIAN CHEMICAL JOURNAL

A Canadian Journal devoted to Metallurgy Electro-Chemistry and Industrial Chemistry.

Vol. 2 TORONTO, AUGUST, 1918 No. 8

CANADIAN CHEMICAL JOURNAL

DEVOTED TO THE CHEMICAL AND METALLURGICAL INTERESTS OF CANADA.

Published monthly by the Biggar Press, Limited.

540-541 Confederation Life Bldg., Toronto, Canada

Telephone Main 7399. E. B. BIGGAR, Managing Director

Subscription price, $2.00 per year to Canada, United States and all parts of the British Empire.

Time of going to press, 1st of each month. News and changes of advertisements should be in hand one week before.

Principal Contents

Back numbers of the Canadian Chemical Journal are wanted, dating from July to December inclusive. Full price will be paid for copies received with reading matter pages in good condition.

To complete sets of the current volume, the publishers will be glad of back numbers from January to April inclusive, and will pay full price for undamaged copies, or will credit the amount on the sender's subscription.

SPECIAL NOTICES.

The Canadian Chemical Journal has removed from 36 Toronto Street to Rooms 540 and 541 Confederation Life Building. Our friends are welcome to our new quarters, where, with larger space, we hope to lay the foundation for a reference library adapted to the needs of the industry.

It is the intention of the publishers to be represented at the National Exposition of Chemical Industries in New York, in September, where the Journal will have a booth among the other Canadian exhibitors. We shall be glad to serve our subscribers there in any way we can.

As announced elsewhere the fourth annual Exposition of Chemical Industries in New York will be held during the week beginning September 23rd. The floor space to be taken up will be twenty-five per cent. greater than last year, and efforts are being made to make the educational features of correspondingly increased interest. The attendance from Canada appears to grow each year, and we heartily commend it to all who are able to go.

A CORRESPONDENT writes to THE CANADIAN CHEMICAL JOURNAL suggesting that the remarkable physical property of lithium—its specific heat, which is approximately equal to that of water—may be turned to account in the industries. The low melting point of the metal lithium, approximately that of lead, and its readiness to tarnish and decompose on exposure to the air, are difficulties to be overcome, but our correspondent suggests the possibilities of using some alloys which would overcome these drawbacks while enabling the alloy to hold its heat. The subject is well worth investigation.

MENTION has already been made of the project for converting portions of the distillery works of Hiram Walker & Sons, Walkerville, Ont., into works for the production of toluol for explosives during the war and afterwards for the making of toluol, benzol, xylol for intermediates for the dye and color industries. Mr. Niels C. Ortved, the company's technical manager is in charge of the new department, which, as already mentioned, will use the new and

promising process invented by Dr. A. S. Ramage, a native of Edinburgh, now resident in Detroit. A description of Dr. Ramage's process appears in this issue. Operations at the plant will begin this month.

THE paralysis of the work of the Canadian post office by the letter carriers' strike explains why some of the regular features of this Journal, such as our New York, Montreal and Ottawa correspondence, are absent from this issue. No work is so poorly paid as that of letter carriers and postal clerks. The fact that the increases promised to these men and voted by Parliament have been withheld calls for an overhauling of the headquarters staff of the post office department. An efficient postal service is our prime necessity, and if there are obstructionists at headquarters they should be sent into immediate retirement.

SOME account is given in this issue of the activities of the Chemistry Committee of the Advisory Council. An outline of the work taken in hand is given by Dr. R. F. Ruttan, the chairman of the committee, and it will be generally admitted that Dr. Ruttan and his colleagues have shown great energy in labor, as well as good judgment in the choice of the problems attacked. There is no door of opportunity so widely opened by the war as that of chemistry in its various branches, and the Advisory Council have laid a good foundation in the studentships and fellowships that are being founded to give bright young men and women the chance of doing creative work.

THAT chemistry offers a promising life occupation for women is becoming apparent from such items as that appearing in this issue regarding the high school and university girls who have been offered work at the new plants at Shawinigan Falls. The election of a lady to preside at the International Mining Convention in British Columbia is another significant event of like import in the tendency to outlive the prejudice against women in the practical business of life. At a recent address before the Toronto Section of the Society of Chemical Industry, Mr. Pirrie, of the Imperial Munitions Board, said his bias against women as workers and managers was completely removed when he saw the wonders accomplished by them in the chemical, munition, aeroplane and other war industries which he inspected on his return to Great Britain.

REFERENCE was made last month to the comprehensive review of the Canadian chemical industry by Dean Goodwin at the annual meeting of the Canadian Manufacturers Association. Some extracts are now given from Dean Goodwin's address on topics that deserve further emphasis. It is encouraging to learn from leaders in the association that Canadian manufacturers as a class now comprehend more clearly than ever the value of the service which the chemist and metallurgist can and will render to the industrial worker and his employer. On their part the chemists now better realize the duty they owe to all industries, including agriculture, in rendering the utmost service their talents can provide for the application of science to the practical affairs of life. This was formally acknowledged by the Society of Chemical Industry at a meeting in March attended by leading chemists of all the allied countries when it was laid down that further progress required: 1st, "closer collaboration between science and industry"; 2nd, "respect for individual liberty and property," and 3rd, "development of technical education, of plant, of means of transport and exchange."

Dehydrogenation of Petroleum Oils and Other Hydrocarbons

By Dr. A. S. Ramage

It may be well just to give a short resume of the work done on this subject.

Berthelot in 1867 to 1870 in several papers showed the principle of the production of the aromatic hydrocarbons, benzol, toluol, etc., by "pyrogenation." In 1867, he showed that by passing the vapor of acetylene through a tube heated to a dull redness, benzol was produced. He also showed that at a higher temperature, over 700, the benzol produced was again decomposed so that the action depended absolutely upon the temperature. He also showed that mixtures of acetylene and allylene produced in a similar manner toluol. These principles of pyrogenation were checked up very conclusively by many of the chemists of that age and upon this principle the whole of the practical work of "cracking" is based. There is not a process in use to-day that is not founded upon this principle, although many theories have been propounded, for instance, Burton's and of recent years Rittman's, about the size of the molecule. The fact remains that all the processes that have been worked and are now being worked are based simply upon this one fact of bringing the vapors of the coal tar or petroleum products into contact with surfaces heated to a red heat.

In order to more clearly express the possibilities that have been at the base of all these processes in the coal tar industry, it is necessary to understand the effect of the differences of temperature while distilling the coal.

Since 1860, they have been well known, and many industries and many works have used the processes of low temperature distillation. At low temperature distillation, such as 400 degrees C. three times the amount of tar oils are produced and at least twice as much ammonia. At low temperatures, as much as 65 to 125 gallons of tar oils have been produced in practise leaving a coke of superior burning qualities, as it will ignite easily and burn with a flame without smoke. Such a fuel has demonstrated its value against ordinary coke under the name of "Coalite," which was produced at a temperature of 420 degrees C. The amount of oils produced by these low temperature distillations averages 50 to 60 gallons with larger amount of ammonia. But these oils are of an entirely different composition to the tar produced at temperatures from 800 degrees C. up, and are absolutely valueless to the tar distiller as they contain nothing but olefines and a little solid paraffine and

acids which are of the higher cresylic group. They are entirely wanting in the valuable constituents of coal tar, viz.: benzol, toluol, xylene, solvent naptha, carbolic acid, napthalene and anthracene. Later on, 1880, after the principle of pyrogenation was thoroughly understood, it became apparent that the shape of the retort was vital, as well as the temperature. It is apparent that in a vertical retort the ascending gases and vapors of tar will not come in contact with the red hot walls as is the case with horizontal retorts, thus these vapors will not decompose by pyrogenation and much larger yields of tar and ammonia is the result.

The first vertical retorts, which were taken out in 1880, were Young's of Young's Paraffine Oil Works, Scotland, for the distillation of coal at low temperatures. Then followed Bielby's of Oakbank, in Scotland, 1881, who kept the upper part of his vertical retort at a temperature of 400 degrees increasing the heat until the lower part of the vertical was red hot. He used a continuous distillation as the coal descended continuously through the retort, all the tar being driven off in the upper region heated to 400 degrees. As it descended into the hotter regions, steam was injected to take up the nitrogen left in the coke, thus forming very largely increased yields of ammonia.

During the next ten years, a number of patents on improved vertical retorts were issued to Henderson, of Broxton Oil Works. Later in 1905, Bueb took out German patent 167,367 and in 1906, German patent 259,325. They were put in use in Warsaw on a very large scale and I give the result of the comparisons of the tars produced by his vertical and the horizontal retorts which were still used there on the same coal and at the same temperature.

	Vertical	Horizontal
Free carbon	2.00%	20.00%
Light oils	5.85	3.10
Middle Oils	12.32	7.68
Heavy oils	11.95	10.15
Anthracene oil	15.96	11.64
Pitch	49.75	62.00

About 50% less naphthalene was produced from the verticals.

Now the point can be seen why the Berlin Soeiety for the promotion of Industry offered a special prize in 1877 for any process that would convert these low temperature tar oils or pretoleum residues into the valuable tars produced by the high temperature distillation of coal, such as benzol, toluol, carbolic acid, napthalene and anthracene. Immediately following the offer, innumerable experiments were tried on a practical scale In each and every one of them the principle of pyrogenation was adopted. I will simply mention a few of them as it will show that there is no such thing as a new process such as those known by the name of Burton, Washburn, Seeger, Snelling or Rittman, but that these are simply forms of apparatus to carry out the well known principles of pyrogenation.

Liebermann and Burg passed the oils from low temperature coal distillation through red hot tubes filled with porous material and obtained 4% benzol and toluol; 9% anthracene. Similar to the above were the results of Salzmann and Wichelhaus and also Atterberg. The best work that was done was accomplished by Letny on heavy petroleum oils which he passed through red hot tubes filled with wood and obtained an entirely similar product to the coal tar of high distillation. He then used red hot charcoal in the tubes with a similar result. Further experiments show that if he increased the pressure he got less gas and the coal tar he obtained contained very much larger percentages of the low boiling point hydrocarbons. His work was done on the petroleums from Baku, Russia.

In 1879, work was carried out in Lunge's laboratory to demonstrate that the Russian petroleum could be converted in this way into the coal tar products of benzol, toluol, naphthalene, and anthracene and in 1881 this process was adopted in Kassan Gas Works, Russia, with great success, the object being to convert the petroleum residues from Baku into gas and tars containing the aromatic hydrocarbons.

In 1882, according to Liebermann, the petroleum residues were converted in this manner industrially by Nobel at Baku, the anthracene and napthalene being very pure. The benzol although boiling at its natural boiling point would not make nitrobenzine but later on was purified by freezing at -14 degrees C. and then yielded pure nitrobenzine. In 1884, Nobel's plant at Baku was visited by Redwood who gave an account of the same in 1885 in the Journal of the Society of Chemical Industry, page 79.

Hiawaty in 1891 received a German patent 51,553 in which he passes strong superheated steam into the petroleum mixed with one third sawdust, one third quick lime. The vapors are passed through red hot tubes filled with iron or carbon, then through a condenser, the liquid obtained being of the same nature as the aromatic hydrocarbons, the gases passing on being mostly acetylene which passed through tubes at a dull red heat and produce benzol exactly as Berthelot did in 1867.

Thorpe and Young in Scotland in 1871 published their experiments on the action of heat and pressure on solid paraffine. They used 3,500 grams of paraffin and obtained 4 litres of liquid hydrocarbons composed of paraffins of a low boiling point and olefines. Young obtained a patent in 1865 in Great Britain where he distilled the hydrocarbons under pressure, which was obtained by a loaded valve, and a much higher temperature than the boiling point of oils treated.

Dewar and Redwood, four years after Redwood's return from witnessing Nobel's plant, obtained a British patent in 1899 in which they distilled at a high temperature coal tar oils obtained at low temperatures and under a high pressure of carbolic acid or other inert gas. Nikiforow, British patent 19,957, of 1887, and 23,174 of 1901, splits up petroleum residues into fractions by strong heat applied under pressure. They are first vaporized under ordinary pressure at 550 degrees, passing into a receiver kept at 200 degrees. The vapors are then condensed and distilled over into fractions up to 100°, 130°, 160°, 180°, 200°. The fractions are then decomposed in a retort which is kept at 700° for the lightest and 1200° for the heaviest under a pressure of two atmospheres. A very favorable report on this process was made by Oglobie. It was worked on a large scale at Kineshma, Russia, employing high temperatures and pressure.

In 1907, Nikiforow again took out a British patent 17,450 for injecting these fractions by water gas through a retort heated to from 800° to 850°. The water gas is heated to 800° and the oil fractions to 200° before being injected. He catches the carbon in a catch box provided with a stirring arrangement and produces 15% benzol, 4% naphthlene, ½% anthracene and 19–20% carbon, 50% gas.

Since then there have been many processes taken out, especially in the United States, more particularly for the production of motor spirits. Dr. Burton, of the Standard Oil, has so far been successful to a certain degree by cracking the oil under pressure of 300 pounds to the square inch in stills. The process is simply a modification of that of Young of 1865 and of Dewar and Redwood of 1889. It is of little interest to consider the processes of Hall, Seegar, Washburn, Greenstreet and Rittman, also Jenkins. They are all processes where the oil is cracked with deposition of carbon and liberation of hydrogen to a more or less degree. Teslin and Renaud, of Belgium, have a similar method, but with the admission of superheated steam, same as used by Greenstreet, and in this way burn up some of the deposited carbon. All these processes are more or less successful, but are very hard on the apparatus used, owing to the high temperatures and pressures.

Their motor spirit is a mixture of olefines and paraffins. It has always been a question as to whether unsaturated hydrocarbons are as well suited for internal combustion engine as the paraffins, although being unsaturated, it stands to reason they

ought to combine with the oxygen of the air with greater intensity than the inert paraffin. The serious condition of the fuel question this year, has caused the Government to make many extended researches on this matter, and it is now recognized officially that olefines are much better products for a motor fuel. More perfect combustion is obtained and a steady pull at slow speed with full load are characteristics of all the unsaturated fuels. Knocking is almost absent. The engine can be operated with advanced spark, almost to a standstill. France is the only country at the present time which has not acknowledged these facts, and their only objection to the use of olefines has been the question of polymerization.

The U.S. production of gasoline during 1917 was 45,000,000 barrels of which ten million were exported, leaving thirty-five million barrels of low grade gasoline with an end boiling point of 232C. The average yield of gasoline from crude oil, taking all the fields into consideration, is 13% low grade. Of high grade gasoline, similar to the English, which has an end boiling point of 120C, the yield last year would have been approximately ten million barrels.

U.S. has talked of placing thirty thousand aeroplanes in the front this year. As a matter of fact one thousand fighting planes would consume one million barrels with its accessory machines or one tenth of the entire production. It is to be seen that the increased production of motor fuel, especially for aeroplanes, is one of the utmost importance.

In my process my endeavor has been not to crack the oil, but to obtain a definite chemical reaction, namely—the dehydrogenation of the paraffin to the olefine. In other words, our product is a motor fuel which practically is 95% olefine—the other 5% being further unsaturated products. Water is always produced in dehydrogenation, and is condensed and separated from the fuel in the receiving tank. The reaction can be carried as far as the aromatic series, depending entirely upon the temperature and length of tube through which the vapors are passed. The reaction is as follows:

Parrafines Olefines

$$C_nH_{2n}+2+0=C_nH_{2n}+H_2O$$

Olefines Acetylenes

$$C_nH_{2n}+O=C_nH_{2n}-2+H_2O$$

Acetylenes Terpins

$$C_nH_{2n}-2+O=C_nH_{2n}-4+H_2O$$

Terpins Aromatics

$$C_nH_{2n}-4+O=C_nH_{2n}-6+H_2O$$

The vapors are passed over heated iron oxide Fe_2O_3. At the temperature for motor fuels of 620C. the oxygen is taken up with the reduction to the oxide Fe O at which stage we stop the action; steam out the oils remaining in the oxide for five minutes and re-oxidize with a current of air for fifteen minutes. We are very careful not to allow the reduction to go beyond FeO, because if metallic iron is formed, cracking immediately takes place with deposition of carbon. The action of dehydrogenation is endothermic, whereas the rexodization is of course exothermic. The period of dehydrogenation lasts for three hours in practice and the revivification one half hour.

Our first production was in a laboratory tube, electrically heated, two feet, followed by a tube 3 inches diameter, 4 feet long—then by a tube 10 feet long 3 inches diameter. Our conversion of the original oil would always run 36%, once run through the tube. Since then we have extended the tube to 24 feet and our conversion averages 90% of the original oil, and the recovery 94 to 95%. No carbon has been produced. After steady running of eight months, the iron oxide was removed from the tube and not a trace of carbon was found in it.

The works were built at River Rouge on a practical scale. After several fires, it was burned down and a new works has been erected at Ecorse.

Furnaces containing tubes 8 inches diameter, 22 feet long, are now adopted as the best length and diameter with the feed of ten gallons per hour per tube. For a motor fuel to correspond with the present ordinance for gasoline, a temperature of 600 to 620 is kept in the lower half of the tube. The waste heat from the oil burners heating the lower half of the muffle is led off at the upper end of the furnace, giving a temperature of 400 at the upper end where the oil enters to 600° where the vapors issue. We have found that by this progressive heating of the tube the product is not scorched and comes out of the condensers a deep straw color, whereas the passing of the oil or vapors immediately into 600°C. cause the product to become dark and contain some tar. Progressive heating is one of the features of the process. A simple distillation of the condensate wih 1% Fullers Earth being sufficient to refine the spirit. If we raise the temperature to 650, we obtain a product running as high as 50% under 120 C, and at 680°C practically all of our product comes over with an end point between 120° and 130°C. I mention this fact because of its application, not only to the aeroplane industry but the production of low boiling olefines as a starting point in the organic chemical field.

It is perfectly feasible and does not add materially to the cost to obtain 80% of the original oil with an end point of 45°C being composed of amylene and low boiling point olefines. One particular point about olefines is the wonderful solubility of ethylene in them. Ethylene is produced in quantity when we are running to obtain very low boiling point spirits, and the gas is compressed and passed through the spirit under pressure of 100 pounds to the square inch. Fifteen times the volume of ethylene is absorbed and the peculiar point is that after releasing the pressure, the ethylene is not given off at normal temperature but seems to be held in some loose form of combination because at between 40 and 50 C it commences to come off in great volume. The value of this gas dissolved in the motor fuel in such loose form connection as to be so readily given off probably accounts for the quickness with which this fuel ignites, even below zero.

From the commercial standpoint, I may simply mention that the refiners who are selling this fuel to customers, while of the same standard as gasoline, have found that they demand this fuel all the time. Kerosene is the hardest to convert, and as the boiling point advances to oils boiling at 350°, the more readily are they converted. No carbon is formed in this reaction, and not a trace of naphthalene.

Of more interest to chemists are the products obtained upon further dehydrogenation. Practical results have shown us that with the tube length of 50 feet, and a feed of ten gallons per hour from 20 to 30% toluol can be produced, not counting the other aromatics. In toluol production the upper end of the tube is kept at 400 and the lower end at 750. In the conversion of Xylol $C^6 H^4 (CH^3)2$ as high as 72% has been obtained of the benzol—toluol fraction containing 30% benzol; the balance toluol. In the separation of aromatics from olefines present the usual sulphuric acid treatment is followed. I find, however, that this reaction which has always been used is very incorrect and not more than 20% of olefine is reacted upon, the balance of the olefines being polymerized to high boiling point olefines. For instance—with anylene C_5H_{10} two atoms condensed to form $C_{10}H_{20}$ the boiling point 165C, also 3 atoms combined to form C_{15} H_{30} triamaylene with a boiling point of 248 and four atoms combined to form C_{20} H_{40} tetraiamylene with a boiling point of 400. Therefore, from a product boiling at 40C. we have produced 80% of a product boiling at 165, 248 and 400 C., the latter forming a capital non-freezing lubricant. These products are all oxidized by chromic acid mixture into acetone and acetic acid. The other 20% which combined with the acid formed hydrogen amylsulphate which we hydrolize by the addition of water and distill off the amyl alcohol. Butylene has the same action with sulphuric acid. It is a characteristic of

the olefine group to be very prone to either sission, or on the other hand—polymerization. This I think gives us the reaction which takes place in the tube, and it is the reason we obtain all low boiling point olefines. The first reaction is a simple one of dehydrogenation whereby parrafin loses two atoms of hydrogen and forms the olefine. For instance $C_{10}\ H_{22}$ becomes $C_{10}\ H_{20}+H_2O$; the $C_{10}\ H_{20}$ in the presence of the iron oxide acting as catalyst breaks down into two atoms of amylene $C_5\ H_{10}$. The polymerization of the olefines of the class up to $C_{10}\ H_{30}$ on distillation again becomes changed so that they are again susceptible to the reaction of the sulphuric acid with further polymerization into the higher boiling point polymerized bodies.

At present we are simply carrying out this reaction with the object of removing olefines from benzol and toluol with the production of lubricating oil. As all these polymerized bodies have a much higher boiling point than toluol, it can readily be seen that benzol and toluol fractions can be distilled off in a cut 90% pure. We do not need to rectify the toluol but can immediately nitrate to mono product, because on treatment with 5% solution of caustic soda the nitrated polymerized body present is immediately dissolved out, leaving the mono nitro toluol chemically pure. The value of this can be seen when up to the present time it has been impossible in practice to obtain T.N.T. from the toluol product from the cracking of parafines. This does not apply to the toluol produced by the cracking of the Russian and California oils or the shale oils of Scotland, which are principally olefines or that produced from the cracking of xylol, there being in these products no parrafins present.

It can be seen by the simple dehydrogenation of the petroleum oils, we are in a position to produce olefines, acetylenes, terpines and the aromatics, and from these bodies the alcohols and various organic products. In my mind, this is the greatest end of the process, although probably the motor spirit is at the present time the greatest commercial feature.

Papers before the Royal Society of Canada

The following are notes of some of the papers read at the recent annual meeting of the Royal Society of Canada:

"The Angle of Contact made with Glass by a Mercury Surface which is Covered with Another Liquid," by Dr. A. L. Clark, F.R.S.C., Queen's University. When pure mercury is in contact with clean glass and covered by air, the angle of contact is large. If the mercury be covered by pure water, the angle is about 4°. When the water is replaced by a dilute sulphuric acid solution the angle becomes zero. The paper is an account of measurements of the angle of contact with acid of various concentrations and the conclusions derived from the experiments.

"Notes on the Halifax Explosion," by Howard L. Bronson, Ph.D., F.R.S.C. The paper gives a brief account of such scientific data as the writer has been able to obtain regarding the great explosion at Halifax on December 6, 1917. It includes information regarding the quantities and nature of the explosives and estimates of the volume of gases formed together with their temperature, pressure and energy. The record of the explosion as recorded on the seismograph at Dalhousie University is discussed as well as several Halifax baragraph records. A brief account is also given of the nature and extent of the damage caused by the explosion and some attempt is made to explain the various phenomena, but no very satisfactory conclusions have been reached. The account is fragmentary and it is hoped that it may be possible to supplement it at a future date.

"Researches on Sound Measurement with Reference to the Testing of Fog-signal Machinery: an Account of Tests Carried out at Father Point, Que., September-October, 1917," by Louis Vessot King, D.Sc., F.R.S.C., McGill University. The fog-signal tests undertaken by the writer in 1913 were continued under the auspices of the Honorary Advisory Council of Scientific and Industrial Research. Acoustic surveys were carried out with much more complete meterological data than had been obtained previously. With the co-operation of Professor Dayton C. Miller of the Case School of Applied Science, Cleveland, O., the quality of the sound produced by the diaphone was successfully studied by means of the "phonodeik." A series of photographic records of the sound was obtained to distances of nearly three miles. Acoustic efficiency tests were also carried out on a small two-inch diaphone by the thermo-dynamic method first employed in 1913. The reliability of the method as a practical means of measuring the acoustic radiation from the diaphone or siren was fully established.

"A Comparison of some Anemometers," by A. Norman Shaw, D.Sc., Macdonald College, McGill University. Presented by Dr. Louis V. King, F.R.S.C. An account is given of a comparison between the Robinson cup, the hot-wire, and the pitot-tube anemometers: also the katathermometer used as an anemometer. The accuracy of a pitot-tube of very simple construction and the use of such an instrument in measuring small fluctuations in atmospheric pressure and movement are also discussed.

"New Series in Metallic Spectrum," by R. V. Zumstein. Presented by Dr. E. F. Burton, F.R.S.C.

"Rhythmic Precipitation in Gelatine," by Miss A. W. Foster. Presented by Dr. E. F. Burton, F.R.S.C.

"The Radioactivity of the Natural Gases of Canada," by John Satterly, D.Sc., F.R.S.C. The gases from the natural gas wells in Ontario, Alberta and British Columbia and from some springs in Quebec have been examined for radium emanation and the amount measured. An attempt has been made to correlate the radioactivity with some of the other chemical constituents of the gases and with the geological strata from which the gases are drawn.

"The Viscosity of Rubber Solutions and its Relation to the Commercial Properties of Rubber," by Richard Hamer. Presented by Dr. E. F. Burton, F.R.S.C.

"On an Electrical Method of Determining the Lime Requirements of Soils," by C. J. Lynde, Ph.D., Macdonald College. Presented by Dr. F. T. Shutt, F.R.S.C., Dominion chemist. The theory upon which this work is based is as follows: If a soil is shaken with water, a soil solution is obtained which has a certain electrical resistance; if then an equal weight of the soil is shaken with an equal volume of a dilute fertilizer solution of known electrical resistance, a solution is obtained which has a different electrical resistance. If the soil does not absorb the fertilizer the resistance obtained can be calculated in advance if, however, the soil does absorb the fertilizer the resistance obtained is greater than this calculated value. It seemed possible that the greater the requirement of the soil for a given fertilizer the greater would be its absorption of this fertilizer, and if so, that this might lead to a method of determining the fertilizer requirement of a soil by measurement of the resistance of the solutions formed when the soil is shaken with dilute fertilizer solutions. The present paper is limited to the results obtained in an attempt to measure the lime requirements of a soil.

"Sulphuric Acid Vacuum Pump," by O. Maass. Presented by Dr. R. F. Ruttan, F.R.S.C. By means of this pump vacuo distillation and concentration of solutions at low temperatures can be carried out with great rapidity. The pump may be used both on a large and on a small scale.

"Bog Butter," by Dr. R. F. Ruttan, F.R.S.C. and L. Isabel Howe. This paper gives the results of the analysis of fourteen specimens of butter which were found in the Bogs of Ireland and preserved in the museums of Dublin and Belfast. Some of these specimens are of great antiquity. It has been found that the changes are very similar to the changes when animal fat passes into the condition known as "Adipocere."

"Fats of the Isomeric Propylene Glycols," by L. Isabel Howe and Dr. R. F. Ruttan, F.R.S.C. This paper shows the relation between the fat acid esters of the Propylene Glycols with those of Ethylene Glycol and the true fats as well as the effect of the isomerism of Propylene Glycols upon the properties of fat acid esters.

"Latent Valency of Unsaturation and the Formation of Molecular Compounds," by O. Maass and J. Russell. Compounds between toluol and hydrobromic acid, ethyl, benzene and hydrobromic acid, etc., were shown to exist by means of freezing point determinations and their nature discussed.

"Preparation of Pure Concentrated Solutions of Hydrogen Peroxide in Large Quantities. Preparation of Pure Hydrogen Peroxide," by O. Maass and O. Herzberg. Pure hydrogen peroxide solutions were prepared and some of their properties determined. A method for the easy preparation of pure hydrogen peroxide was devised and some of the physical properties of the pure hydrogen peroxide determined.

"Determination of the Gas Constant of Acetylene, Methyl Ether and Hydrobromic Acid," by O. Maass and J. Russell. The method employed consisted in condensing definite volumes of these gases by means of liquid air and weighing them in sealed bombs.

"A Study of Some of the Properties of Oxynitrilase," by W. A. Wieland and V. K. Krieble. Method for extraction of enzyme. Methods to follow the rate of chemical reaction as well as the rate of production of optically active nitrile when hydrocyanic acid and benzaldehyde react in the presence of the enzyme. Effects of temperature, concentration of substrate, alcohol and hydrogen ion on the rates of the chemical and enzyme action.

"An Agricultural Source of Benzoic Acid," by Frank T. Shutt, D.Sc., F.R.S.C., and P. J. Moloney, M.A. A new method is proposed for commercially obtaining benzoic acid from the urine of herbivorae and its efficiency is discussed.

"The 'Alkali' Content of Soils as Related to Crop Growth," by Frank T. Shutt, D.Sc., F.R.S.C., and E. A. Smith, M.A. The nature and concentration of "alkali" as occurring in the soils of certain semi-arid districts of Western Canada have been studied during the past four years in the laboratories of the Experimental Farm system. The data so obtained have materially assisted in the classification of the areas in question into irrigable and non-irrigable lands. For the purpose of applying these data American standards as regards safe limits of alkali have largely been used. The results presented in this paper are a contribution towards the establishment of standards more particularly adapted to Canadian conditions.

"The Utilization of Nitre Cake in the Manufacture of Superphosphate," by Frank T. Shutt, D.Sc., F.R.S.C., and L. E. Wright, B.Sc. Experiments recently conducted in the laboratories of the Experimental Farm, Ottawa, show that a Superphosphate containing 15% of available P_2O_5 can be readily produced from Florida Pebble Phosphate, and one with 9 to 10% from Canadian Apatite by the mixing of the finely ground materials with Nitre Cake, the reaction taking place at room temperatures.

Society of Chemical Industry

The officers of the Montreal section of the Society of Chemical Industry, as declared elected at its meeting on the 10th May, are as follows:—Professor N. N. Evans, Chairman; Mr. W. B. Campbell, Secretary (address, 700 University Ave.). Committee: Mr. Ivan Grageroff (Canadian Explosives, Limited); Mr. N. Holland (Holland Varnish Co.); Mr. James Walker (Standard Chemical Iron & Lumber Co.); and Dr. John S. Bates (Forest Products Laboratory).

The Tar Sands of Alberta*

By Dr. A. F. L. Lehman, University of Alberta

The extensive "Tar Sands" deposits of Northern Alberta have been surveyed and mapped by Mr. S. C. Ells, of the Mines Branch of the Department of Mines, and the results have been published in the reports of that department. Numerous outcrops of these deposits occur in the steep banks of the Athabasca River and its tributaries of Fort McMurray. The area of these outcrops covers thousands of square miles; and many of these are more than 100 feet thick. The mass of material is therefore truly enormous. Owing to this material being present in such immense quantities, it has attracted very keen and widespread interest and a demand for a thorough investigation.

The extensive use to which asphalts have been put for paving purposes suggested the use of these "Tar Sands," or "Bituminous Sands" as a substitute, and numerous successful experiments have been made in that direction. One of these on a somewhat larger scale, made by Mr. Ells in Edmonton, is frequently shown to visitors. It has satisfactorily withstood fairly heavy traffic. There is no doubt that these sands can be used for paving purposes, but the large percentage of sand which they contain (in the samples we experimented with, a little over 82%), makes the transportation of this bitumen relatively very expensive. This, together with the fact, that the sands in these "Bituminous Sands" do not form an ideal "aggregate" has led to numerous suggestions for extracting this bitumen from the sand.

One method, which recommended itself to Mr. Seyer and myself, on account of the possibility it might have of forming benzol derivative, was distillation. The "Bituminous Sands" or "Tar Sands," as it is generally called, was filled into a one and a half inch tube (1½") and placed in a furnace. By heating the tube to red heat, 70 to 80% of the bitumen was recovered as a relatively mobile liquid. Increasing the diameter of the tube materially reduced the yield of "oil." This oil gradually thickened upon standing, until it again formed a tar-like mass. Fractional distillation gave gasoline and various grades of oil. Cracking began at a relatively low temperature, so that the relative quantities in the various fractions could be changed by changing the conditions of distillation. Concentrated sulphuric acid changed the original oil, as well as the various fractions, to a black solid. The bitumen extracted from the sand by solvents behaved similarly. Refining these oils is therefore likely to present some difficulties.

But our work has been directed chiefly to the determination of the constitution of the bitumen in these sands. For any systematic study of these compounds, that seems the first step to be taken. Benzol derivatives were looked for, but thus far none have been found. Nitric acid reacted violently even at room temperature, producing almost exclusively oxidation products, but little carbonic acid was formed and oxalic acid was invariably the final product. More gentle oxidizing agents gave a complex mixture of substances, in which we expect hydroxy acids to predominate, but the only thing we can state definitely at the present is the bitumen under investigation is a complex mixture of highly unsaturated hydro-carbons, with some sulphur and nitrogen compounds admixed. By fractional solution they can be easily subdivided into groups of compounds. But these groups are still very complex. However, the thought that these very reactive substances might possibly give rise to as extensive an industry as that based on coal tar ought to inspire almost any chemist to surmount apparently insuperable difficulties.

The Dorr Company, chemical engineers, are moving their New York offices this month from Battery Place to the Architects' Building.

*An address before the chemistry committee of the Advisory Council for Scientific and Industrial Research.

Peat Resources of Canada

From a Paper by B. F. Haanel, Ottawa, read before the Montreal Section of the Society of Chemical Industry

(Concluded from last issue)

Nitrogen Content of Peat

The peat bogs so far examined in Canada all exhibit a high nitrogen content. There are, however, certain of our bogs which have an unusually high nitrogen content. Peat, therefore, becomes a most valuable source of nitrogen for the manufacture of ammonia and other nitrogen compounds.

It is not necessary, in this paper, to lay particular stress on the desirability of so utilizing our solid fuels, high in nitrogen that the highest possible recovery of the nitrogen compounds may be realized. Almost everyone who gives the subject the slightest thought, is alive to the necessity of restoring to the exhausted wheat fields and other agricultural lands the much required nitrogen which has been taken out, almost to exhaustion in certain cases, by the repeated raising of the same crops.

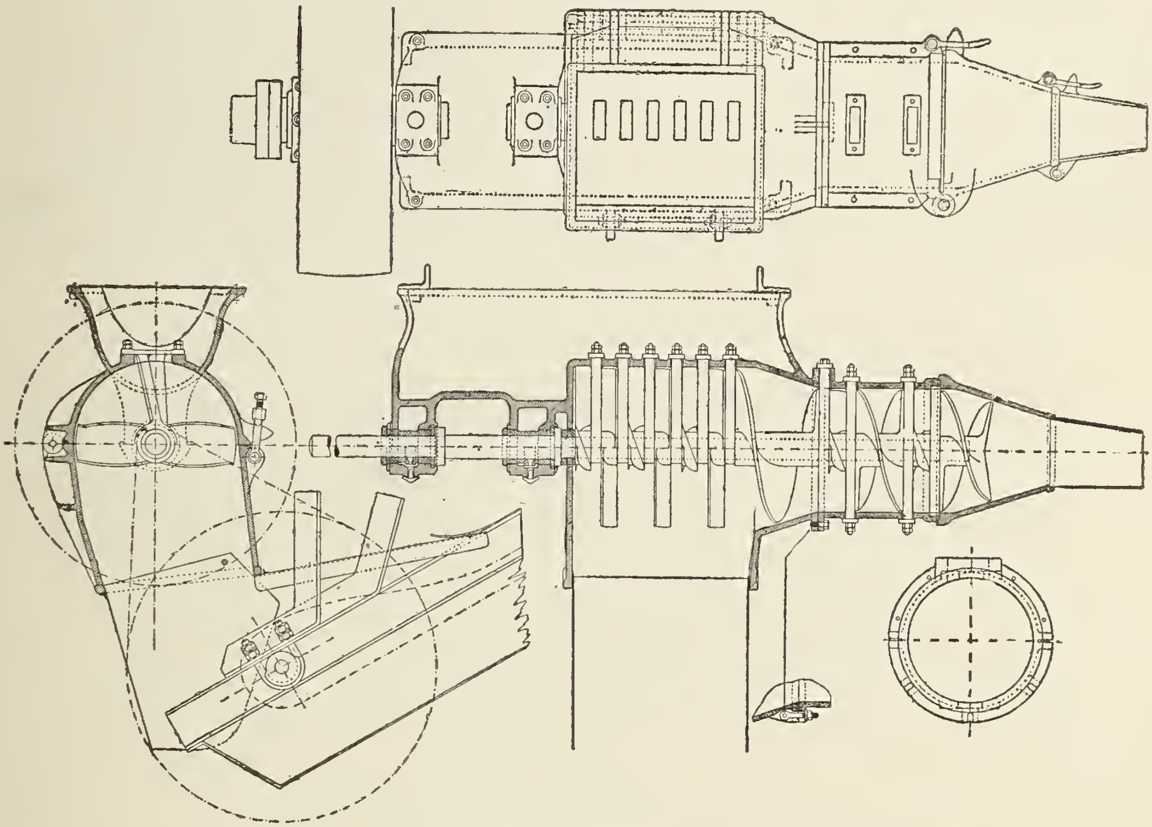
For this purpose, I shall take thirteen of the bogs so far examined in the Province of Ontario, in which the nitrogen content of the peat reduced to a basis of 25% moisture is 1.3%. The total standard fuel content of these bogs is 43,000,000 tons. The total nitrogen available is, consequently, 560,000 tons, and this quantity will give, with present day efficiency of recovery, (as obtains with the by-product-recovery producer) 1,800,000 tons of ammonium sulphate. This, of course, is simply one of the by-products. I shall refer to the process employed later.

This example will again serve the purpose of directing your attention to, perhaps, a hitherto unthought of source of wealth.

The nitrogen content of peat burned by the ordinary methods for the generation of heat—for any purpose whatever—will forever be lost to the inhabitants of the world. It is important that this fact be kept in mind.

Peat Fuel for Industrial Purposes

For power and metallurgical purposes it has been demonstrated that peat is an efficient and entirely satisfactory substitute for coal. Coal, of course, is much more convenient to handle, but the requirements of the one can be fulfilled by the other, providing the cost is the same.



Anrep. Pulping Mill

Nitrogeneous fertilizers are in great demand to-day, and this demand is growing by leaps and bounds, and the world's supply, apart from the abnormal demand made by the war for nitrogen compounds is not sufficient to meet the everyday requirements.

The old style coke ovens, in which the by-products are wasted on a most criminal scale, are being rapidly replaced by by-product-recovery coke ovens, for the purpose of recovering, among other important by-products, the valuable nitrogen compound (ammonia). Now, it is well known that the percentage of the nitrogen content of a coal that is coked in a by-product recovery oven is extremely small, and that, on the other hand, the efficiency of recovery of the nitrogen as carried out in the by-product recovery producer is unusually high, by comparison. It will be interesting now to examine certain of our peat bogs, with a view to ascertaining what quantity of nitrogen could commercially be rendered available.

The problems presented, in the utilization of peat fuel for the generation of a power gas, with or without by-product recovery, have been solved with entire satisfaction, and the use of peat for the generation of steam for power or other purposes is an assured economic fact. So far as the use of peat for metallurgical purposes is concerned, we can point to the by-product recovery peat coking plants in Germany and Russia.

It is strange to say that, in regard to the large peat coke plants operated for some time in Germany, and which, for several years, have been closed down, the companies' statements show that the businesses were profitable. There is no question that the products met with a ready sale and at fairly high prices, so what was the trouble?

Mond by-product recovery producer

The entire trouble is to be found in the difficulty of supplying the requisite quantity of sufficiently dry peat to permit the plant to operate at full capacity throughout the year, and to supply a product (coke in this instance) which could be sold sufficiently cheap on the open market to compete with coal coke.

As coal becomes scarcer, and its price per ton rapidly increases, consequently all the products derived from it, then the above described peat-coke plants will come into their own. This time is not far off.

The burning of peat fuel in gas producers, with or without by-product recovery, present, however, a totally different aspect. In the case of a gas producer without by-product recovery, the fuel is used which experience shows is the cheapest. There should be no mistake about it. The problem is simply one concerning the cost of manufacturing peat fuel of a certain moisture content, and in definite quantities, and this in the light of present day knowledge should not present any difficulties.

In the case of by-product recovery plants, the situation is somewhat different. It is presumed that the principal aim of all by-product-recovery-producer-gas plants, is the generation of a power or industrial gas with the maximum recovery of the principal by-product, ammonia. Consequently, the nitrogen content of the fuel becomes one of the governing factors—in certain cases THE governing factor.

This is a case where peat might successfully compete with coal, even though for a definite heating value peat be more expensive than coal. The profits resulting from the recovery of sulphate of ammonia, which is simply the product resulting from the reaction taking place between ammonia and sulphuric acid, increase rapidly with an increase in the nitrogen content of the fuel. It will at once be evident why certain of our peat bogs, in which the nitrogen content is over 2%, are so valuable for just this kind of exploitation.

Plants of this description have been erected in Italy and Germany, for the purpose of generating electricity and recovering the nitrogen of the fuel as ammonia. One plant, in fact, near Venice, Italy, was established for the sole purpose of recovering the nitrogen content of the peat fuel.

The two Italian plants are in operation to-day, even though at one of the plants the peat is of inferior quality as regards both its calorific energy and nitrogen content, and is exceedingly difficult to win.

The German plant, according to last reports, is out of commission, owing to the fact that the nitrogen content of the peat proved to be too low for profitable operation. Trouble was also experienced in the winning of the fuel. The tars obtained as a by-product at these plants were not considered to be of sufficient value for special treatment, so were burned under the boilers to help conserve fuel.

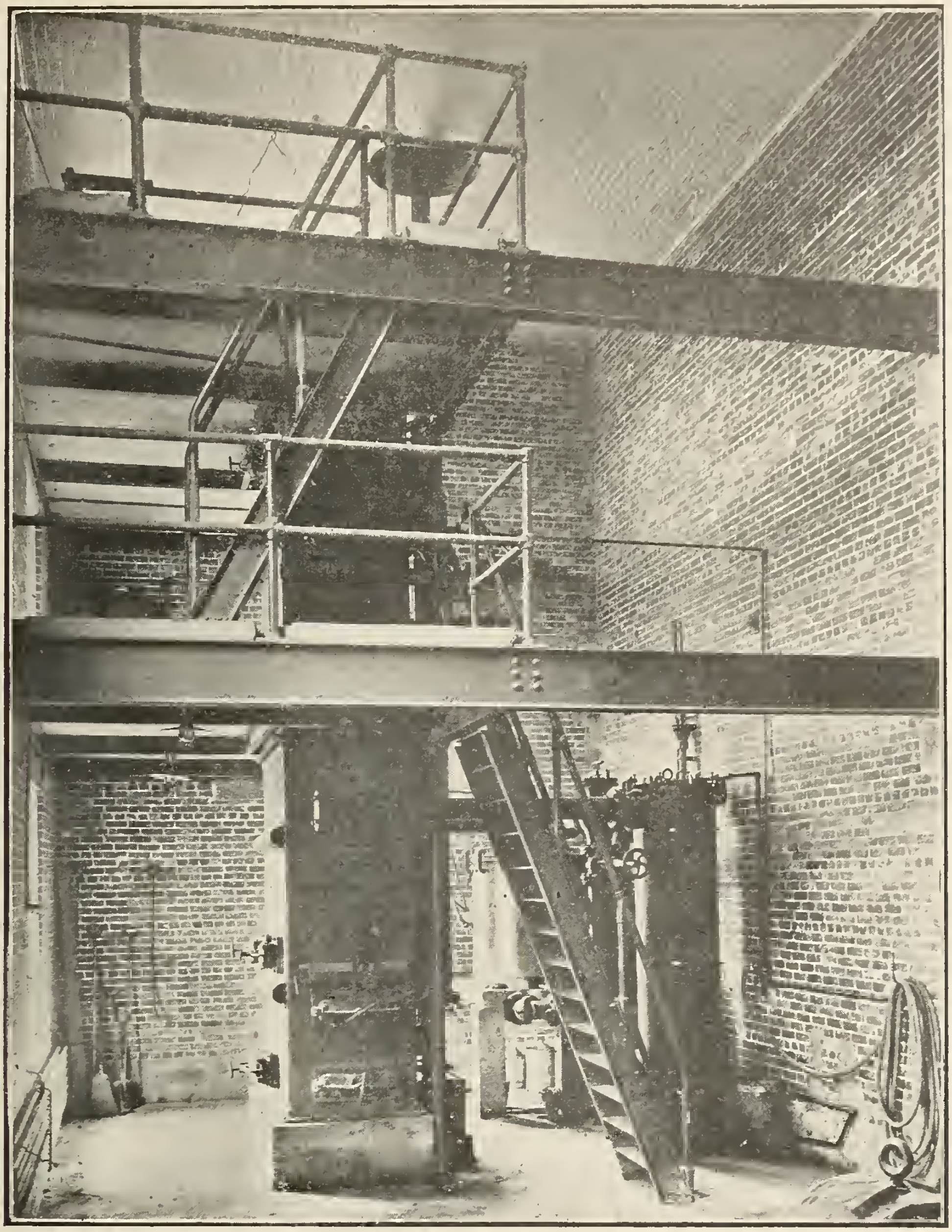
There are several bogs situated near certain of our industrial centres which are exceptionally high in nitrogen, of excellent heating value, and thoroughly satisfactory as regards quantity of fuel. If these bogs were exploited in the manner above outlined, and developed on a sound business basis, failure would be impossible. In fact, it has been shown that, in special cases, a large profit on the investment could be made on the recovery and sale of the sulphate of ammonia alone, i.e., assuming the power gas to be thrown away.

Such installations do not prove profitable when under a certain capacity, e.g., 4,000 horse power is the least capacity recommended. Consequently, the money involved is too great to permit of much playing, as has been the case with many smaller projects associated with peat.

Location of Industrial Plants

The comparatively low heating value of peat fuel, together with the considerable quantity of water present in standard peat, make it imperative that this class of fuel be utililized as close as possible to the source of its manufacture. Only when long hauls are obviated and every possible economy introduced in the manufacture and utilization of the fuel, can peat for general purposes be employed in competition with coal.

A plant logically situated with respect to a city or group of towns or villages within reasonable distances of the plant, could supply a gas which could be used for power, industrial or domestic purposes, thus rendering those communities entirely independent of coal for heat for all purposes. Houses could be lighted



General view of Peat Gas Producer

and heated in the cheapest manner, since the cost of the gas or electrical power would be decreased very considerably by the sale of the by-products, and the initial low cost of the peat fuel manufactured on the site of the plant.

The gas for various purposes could be transmitted through special mains to the towns or cities, and then supplied through the gas mains already in place, providing such arrangement could be made.

A large manufacturing and industrial area in South Staffordshire, England, is supplied with a power and industrial gas generated at a large Mond gas plant situated near a source of low grade coal. There is no reason whatever why similar plants burning peat should not be erected in this country, especially in those portions which are dependent on imported coal for heat (both industrial and domestic).

Peat as a Source of Oil and Retort Gas

The rapidly increasing demand for oils suitable for use in internal combustion engines, and the known scarcity of petroleum products in Canada, naturally prompt us to consider our own available sources of oils.

What are the sources of oil, other than the known petroleum fields of Ontario, which exist in sufficient quantities to become a valuable national asset? The principal source of oil exists in our oil shale deposits of New Brunswick, and, perhaps, those existing in other provinces of Canada. Certain of the lignites of the western provinces, I believe, will in time become a valuable source of oils, and, to a certain extent, peat could be utilized for this purpose.

In the manufacture of peat coke, as conducted in Germany—prior to the war—the following by-products were obtained from the distillation of the tar recovered:

Light oils, for either illuminating purposes or the manufacture of oil gas.

Heavy oils, suitable for lubricating purposes.

Paraffin, phenol, and asphalt.

Tar water, containing ammonia, acetic acid, and methyl alcohol.

516 tons of peat of the following analysis:

Carbon	35.3%
Hydrogen	3.4
Nitrogen	0.7
Sulphur	0.1
Oxygen	28.4
Ash	0.9
Moisture	31.0

Calorific value: 3,792-3,423 calories per kg., or 7,825-6,161 B.T.U. per lb., when coked according to the Ziegler process resulting in the following quantities:

163.7 tons	peat coke.
28.8 "	tar.
269.0 "	tar water.
330.0 "	gases.
0.32 "	loss.

The 25.8 tons of tar yielded on distillation: 11.6 tons light oils; 3.9 tons heavy oils; 1.8 tons paraffin; 7.6 tons phenol; 0.8 tons asphalt; which totals up to 4.5% of the weight of peat coked.

The 269.0 tons of tar water obtained yielded on further treatment:

1.8 tons	methyl alcohol.
0.9 "	ammonia.
2.5 "	acetic acid.

The heating value of the gas produced was 322 B.T.U. per cubic foot.

The above figures were taken from the Mines Branch Report: "Peat and Lignite: their Manufacture and Uses in Europe."

The establishment of a peat industry along the lines I have suggested demands the support of the engineering professions. In the first place, no attempt, hereafter, should be made to manufacture peat fuel without the aid of a well recognized peat engineer—one who is thoroughly familiar with the laying out of a bog for manufacturing purposes, and who is entirely competent to design, erect, and operate the machinery required; and, secondly, no new processes or revolutionary improvements on well known economic existing processes should be given a moment's thought until the manufacture of peat fuel on a commercial scale according to a well known and well tried economic process has been securely established.

The erection of chemical, metallurgical, or power plants designed for the exclusive use of peat fuel, should never be attempted until specialists in the various lines involved are consulted, and the entire proposition considered from every possible angle. If such care is taken, failure will not result, and the erection of one successful plant will lead to the rapid erection of others.

The Chemistry of Milk*

By J. F. Snell, Ph. D., Professor of Chemistry, Macdonald College, Quebec.

According to the census of 1911 the number of milch cows in Canada was very close to 2,600,000. The census and statistics office estimates that in 1917 this number had increased to over 3,200,000 or by about 23%. Like all other commodities the average milch cow has been continually rising in money value during the last decade. In 1909 she was rated at $36. In 1917 she is valued at $84—an increase of 133%. The combined effect of the increase in numbers and prices has been to raise the total value of the milch cows of Canada from $110,000,000 in 1911 to $274,000,000 in 1917. Although the Province of Quebec can properly claim to have some of the best herds of dairy cattle in the Dominion, the average value of Quebec cows is about three dollars less than that for the country as a whole. On the basis of either numbers or value, however, this Province claims well over one-fourth of the milch cows of Canada.

The census value of the dairy products of Quebec in 1910 was nearly $26,000,000—almost exactly one-fourth of that of the Dominion. In the Statistical Yearbook of the Province for 1917, the production in 1916 is estimated at over $48,000,000 and as prices have advanced materially since 1916, we may safely assume that the production for 1917 has about double the money value of that for 1910 and amounts to over $50,000,000. At the same rate the value of the dairy products of the Dominion for the year 1917 must have considerably exceeded $200,000,000.

*A review given before the McGill Chemical Society, April, 1918

The Productivity of the Dairy Cow

All this money is made from milk, the secretion produced for the nourishment of the calf and yet the calf is not sacrificed. The dairy cow is a highly specialized organism—specialized in one of the functions peculiar to mammal females. By breeding and selection this maternal function of milk secretion has been developed to a most amazing extent in some of the specialized dairy breeds. For total production the breed that stands highest is that which originated in Friesland and has been further improved in the United States and Canada, where it is known officially as the Holstein-Friesian breed and popularly as the "Holstein." The development of milk-producing capacity is still proceeding and every few months we hear of a new record. The official championship in milk production recently passed to a British Columbia cow, Zarilda Clothilde 3rd de Kol of the Colony Farm, Essondale, and so far as I know she still retains it. Her production of milk in a year amounted to 30,467 pounds—which would be well over twenty times her body weight. Her record for milk fat (1,071 pounds) is exceeded by a number of other cows of the breed and also by some Guernseys. The previous champion of the Holstein breed, a United States cow with an official milk record of 28,540 pounds, produced over 1,331 pounds of milk fat in a year or at least her own body weight of fat alone. Of course, high records like these are not maintained through all the years of a cow's active life. But I have read an account of a cow sixteen years of age and still milking, which in the thirteen milking periods she had completed had produced over 137,000 pounds of milk or about 102 times her body weight, which was given as 1,350 pounds. This would be an average of about 10,500 pounds of milk a year for the thirteen years. No doubt at the same age some of the present leaders will surpass her in total production.

The total solids of the milk of a cow yielding 10,000 pounds a year would be about 1,275 pounds or about the live weight of an average steer. A steer of this weight would yield a carcass of about 750 pounds weight. Of this meat at least 15% would be bones and other inedible material, leaving 637 pounds of edible meat. Allowing 60% of water we have left 255 pounds of solids or only about one-fifth of those produced annually by the dairy cow in her milk. The fuel value of the edible meat of the steer would be about 723,000 calories. That of the milk of the cow would be 3,150,000 calories. Of the total solids basis, then, the cow's milk would be equal to the beef of five steers and on the fuel value basis to the beef of four and one-third steers.

The champion cow, producing 30,000 pounds of milk, would thus yield as much food in a year as from thirteen to fifteen of her big brothers would give in a life time, and, what is more, both she and her calf would be left alive to continue the work in the future.

Milk as a Dispersed System

The milk of individual cows varies in density from 1.0135 to 1.0397 at 60°F. The mixed milk of a herd rarely falls outside the limits 1.030 and 1.034 and the average density is 1.0322. Water is, of course, the most abundant component and serves as a dispersion medium for the others, of which one, the fat, has a lower density, viz., 0.93, and the others, termed collectively "solids-not-fat" a higher density, averaging, according to Richmond's estimate based on over 200 analyses, 1.616. The condition of the dispersoids of milk varies from that of ions up through molecules and colloidal particles of all dimensions to globules visible under the microscope. Wiegener* estimates the diameter of the various dispersed particles as follows:

Salts—ions, .4 to .5 uu (millimicrons).

Lactose—molecules, .67 to 1.1 uu.

Albumin—amicrons, .5 to 1.5 uu.

Casein—amicrons and relatively few submicrons, 5 to 100 uu.
Fat—microns, 100 to 10,000 uu.
Chiefly 1,600 to 10,000 uu.

The larger the particles the more variable their dimensions, Wiegner remarks. Thus:

The largest fat globule is about 100 times the smallest.
The largest casein particle is about 20 times the smallest.
The largest albumin particle is about 3 times the smallest.

In other words, the more highly dispersed a component is the more uniformly is it dispersed. Wiegener further points out that the more highly and uniformly dispersed a milk component is, the more nearly constant is the percentage of that component in milk in general. The salts or ash constituents are accordingly the least variable of the ingredients of milk, the milk sugar next, then the albumin. The casein shows much wider variability. Van Slyke, writing in 1908, states that he has found the ratio of casein to albumin in herd milks to vary from 2.6 to 5.6. In single milkings of individual animals the variations are of course considerably wider. It is well known that the fat is by far the most variable of the constituents of milk and as it is also the most highly prized constituent the popular and commercial criterion of the value of milk (sanitary considerations aside) is its fat content.

Lythgoe writing in 1910 and 1914 [Jour. Ind. Chem. 6, 899-908] and Sherman in 1912 [Organic Analyses, 2nd Edn., p. 351] give the following as the limits of variation in the various components of milk: (shown on accompanying table).

While Sherman states that he has included only results from apparently healthy cows believed to have been milked regularly under normal conditions, a little doubt may reasonably be entertained whether experimental errors such as faulty sampling may not be responsible for a part of the variability indicated. The minimum value for fat, however, (1.04) was reported from Richmond's laboratory and is therefore no doubt correct. The averages given and the figures for variation are probably rather expressions of opinion than the results of actual calculation. Viewed from any standpoint, however, they are consistent with Wiegener's contention, and they bring out the additional point that the solids-not-fat are less variable than either the fat or the proteins.

The Watering Problem

The detection of added water in milk is a perennial problem. Mere measurement of density obviously does not suffice, since judicially combined skimming and watering may leave the density normal. Watering, of course, lowers the percentage of each and all the solids and may bring any of them below normal limits. Richmond in his Dairy Chemistry states that if solids-not-fat, total nitrogen and ash are all below normal limits the milk may be condemned as watered and he gives a number of methods of calculating the percentage of added water.

A single criterion would, of course, be a great convenience and if it is too much to expect an infallible single criterion it would at least be convenient to have a fairly reliable one to use as a first test. The practical value of such a test would depend on the ease and precision with which it could be applied. Now it is obvious that a criterion based upon the values which show the least variability in genuine milk will excel in precision. Determinations of ash and lactose and of the solids-not-fat—or of physico-chemical values dependent upon these least variable components offer the best promise of a satisfactory solution of the problem.

The determinations of the electrical conductivity, which naturally suggests itself, has not proved a satisfactory means of detecting water. [Durand and Stevenson, Jour. Ind. Eng. Chem. 10, 126-30, 1918.] The colloidal components exert a very material resistance to the passage of the current. [Jackson & Rothera Biothem, J. 8, 1-27 (1914)] report a few careful experiments on separated milk from which they infer that every per cent. of protein in the milk depresses the electrical conductivity by 2.76%. From a comparison of milk from different quarters of the udder, from the left and right breasts in women, and from eight different species of animals, the same authors concluded that the conductivity and the content of milk sugar vary reciprocally, indicating a strong tendency of milk to maintain a constant osmotic pressure. Concordant with this view are the many observations of the constancy of the freezing point of milk and the value of this determination as a test for watering is becoming generally recognized. In Queensland it has actually been incorporated into the legal standard, which demands 3.30% fat., 8.50% solids-not-fat—12% total solids, and a freezing point not higher than 0.55°C. Pliester [Chem. Weekblad, 12, 354-9 (1915)] has found that even in sick cows the freezing point is never higher than--0.54°C. On the other hand Stutterheim [Pharm. Weekblad, 54, 458-9 (1917)] maintains that the usually accepted minimum depression of 0.54° below the freezing point of water is not absolute proof of watering, as he has found depressions of only 0.520 to 0.536° in the milk of poorly fed cows. He places the limit of reliability of the freezing point method at 8% of added water, while Keister [J. Ind. Eng. Chem. 9, 862-5 (1917)] concludes that in fresh milk the limit is at 5% of watering, but that 0.1% acidity beyond the normal for fresh milk (0.15%) counteracts the effect of the 5% added water. A good deal of care is requisite to avoid errors due to too great supercooling during the determination and unfortunately no means of economizing in the time demanded for the determination, which Durand [J. Ind. & Eng. Chem. 9, 44-5 (1917)] puts at ·45 minutes for a duplicate determination, have yet been devised. It would not appear unreasonable to expect the development of a device by which a number of samples could be cooled and frozen simultaneously and their freezing temperatures either quickly read or automatically recorded.

The reciprocal relation between the proportions of lactose and salt has also led to the devising of methods based on determinations of lactose and chlorides. Mathieu and Ferre [Ann. Fals. 7 (1914) 12-21], giving 1 gram of sodium chloride the isotonic equivalence of 11.9 grams of lactose, derive a "simplified molecular concentration constant," $(L + NaCl \times 11.9)$ 1.07, the 1.07 being an averaged correction for the volume of the fat and casein. This so-called constant varies between 74 and 82 according to its authors but Ferris [J. Ind. & Eng. Chem. 9, 957-9 (1917)], applying it to American samples, finds values as low as 71.1. In three samples Ferris found it capable of detecting 8% of added water which is about the limit of accuracy claimed by its authors. Ferris considers the method less accurate than the freezing point method, but useful where it is desired to preserve the sample, as the addition of formaldehyde does not vitiate the results as Keister found it to do in the freezing point method.

Lactose can be conveniently determined by the polariscope, the proteins being removed by precipitation—most commonly with an acid solution of mercuric nitrate or of potassium mercuric iodide. The official method of the Association of Official Agricultural Chemists is a gravimetric one using Fehling's solution, but the polariscopic method is also adopted tentatively. Dehn and Hartman in 1914 [J. Am. Chem. Soc. 36, 403-9] described a colorimetric method applicable to lactose in common with several other carbohydrates, the reagent used being a sodium carbonate solution of picric acid. In a recent paper [Jour. Biol. Chem. 33 (1918) 521-3] Folin and Denis give a simplified modification of this method as applied to lactose in milk, picric acid itself being used to pricipitate the proteins. In the same paper they describe a volumetric copper reduction method which they believe to be more accurate. A 6% solution of copper sulphate is used, solid sodium phosphate, sodium carbonate and sodium or potassium sulphocyanate are added and the milk is measured from a 5 cc. burette devised by Folin and McElroy [Jour. Biol. Chem. 33 (1918) 513-9] for use in urine analysis. This burette is graduated to .02 cc. and is fitted with a fine tip delivering about 50 drops per cc. It is claimed that the proteins

*Zeitschr, Untersuch, Nahrungs u. Genussmittel, 27,425-438. 1914.

do not interfere with the titration of the lactose according to this method.

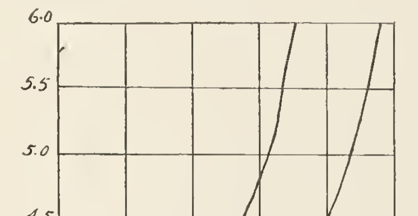
The density, refractive power and ash of the serum obtained by removing casein and fat by precipitation of the former are values which are very useful in the detection of watering. For the precipitation some German chemists prefer calcium chloride, others a mixture of acetic acid and carbon tetrachloride. The A.O.A.C. recognizes tentatively three serum methods: (1) acetic; (2) sour; (3) copper. In all three the Zeiss immersion refractometer is used—an instrument with a arbitrary scale of—5 to 105 degrees, corresponding to indices of refraction of 1.32539 to 1.36640 and capable of being read to .1 scale division, corresponding to an error of only .000037 in the refractive index. The sour serum is obtained by spontaneous souring of the milk, the others by addition of definite quantities of acetic acid and copper sulphate, respectively. The minimum scale readings for pure milk and the minimum quantities of ash per 100 cc. are as follows:

Method	Scale reading	Ash
Acetic serum............	39	0.715
Sour serum.............	38.3	0.730
Copper serum...........	36	

Lythgoe [Report of the Division of Foods & Drugs, Mass. State Board of Health, 1915, 104 pp.] concludes from the results of many years' experience that sour serum values below those cited may be taken as absolute proof of watering.

Natural Milk and Legal Standards

Milk containing a high percentage of fat contains also a high percentage of solids-not-fat. Thus milk with 3% of fat will never have over 8.5% of other solids, while milk with 5% of fat will never have less than 9% of other solids and may have as high as 9.7%. To make clear the relations existing between the solids-not-fat, and the fat in genuine milk with the object of deciding whether in adopting a standard of 8.5% solids-not-fat, the City of New York was enacting legislation conflicting with the State standard of 3% fat and 11.5% total solids or was, as the dealers claimed, setting a standard which the cattle could not meet, Brown and Ekroth [Journ. Ind. & Eng. Chem. 9, 297-9 (1917)] constructed a diagram, reproduced herewith in



Zone of Composition of Milk—After Brown and Ekroth

simplified form, illustrating the limits of composition of genuine milk. This diagram, based upon the result of over 200,000 analyses, English and American, shows a zone of composition within which a milk must fall if genuine. Reference to the diagram will show that no milk containing only 3% fat could meet either the State's requirements of 11.5% total solids or the City's standard of 8.5% solids-not-fat, while the many samples showing 3.25% of fat would meet the State requirement for total solids without coming up to the City's standard for solids-not-fat. In collating this great body of experimental data Brown and Ekroth have performed a notable service and it is to be hoped that, in future, legislators fixing milk standards will have due regard to the natural composition of milk and will avoid or eliminate present absurdities such as the requirement of 9.75% solids-not-fat (Minnesota) or the coupling of so low a fat limit as 2.5 with so high a total solids requirement as 12.0 (Rhode Island).

Composition of Milk Fat

A notable investigation of the question of the distribution of the fatty acids in milk fat has recently been published from the Institute for Research in Animal Nutrition in the University of Leeds. The investigation is notable both for its distinctive method of attacking this by no means new problem and for the thoroughness with which the method is applied. Most of the previous investigators had based their separations on differences in the solubilities of the several salts in certain solvents. The present investigators, Crowther and Hynd [Bio-chem. Jour. 11, 139-163] converted the dry butter fat into methyl esters by heating in ethereal solution with methyl alcohol containing a small percentage of hydrogen chloride.

The methyl esters were then fractionally distilled, the latter part of the distillation being conducted under a pressure of about 15 mm. The two fractions obtained under atmospheric pressure were assumed to consist of butyrate and caproate with a little oleate. Each of the eight fractions obtained under reduced pressure was assumed to contain the esters of two saturated acids together with oleate, which was present in small proportions in the lower fractions and in much larger proportions in the higher ones. The amount of oleate was estimated from the iodine absorption and the proportions of the two saturated acids in each fraction were then derived from the saponification value. The method was very satisfactorily checked by an experiment in which an artificial mixture of pure fatty acids in proportions similar to those from butter fats was subjected to the same process. In the following table the results are compared with those of Browne, which they in the main confirm.

Acid	Dairy Butter	First Runnings	Last Runnings	Average	Browne
Butyric...........	4.45	4.30	4.06	4.27	5.45
Caproic..........	1.45	1.98	1.48	1.64	2.09
Caprylic..........	0.99	1.11	1.37	1.16	0.49
Capric...........	1.10	1.51	0.96	1.19	0.32
Lauric............	3.55	5.08	6.40	5.01	2.57
Myristic..........	20.13	10.38	18.78	16.43	9.89
Palmitic..........	15.24	17.47	11.78	14.83	38.61
Stearic...........	1.08	5.93	3.19	3.40	1.83
Dihydroxystearic...	0.68	0.30	0.16	0.38	1.00
Oleic.............	45.47	46.49	41.31	44.42	32.50

The first runnings and last runnings show notable differences in the proportions of myristic, palmitic and stearic acids, and the author's results on palmitic and oleic differ materially from Browne's. A sample of fat from ewe's milk examined in the same way was found to contain a higher proportion of butyric, caprylic and capric acids than cow's milk fat.

Milk Pigments

In conclusion I wish to refer to the work of Palmer and Eckles on the coloring matters of milk. (Univ. of Missouri, Agr. Expt. Sta. Research Bulletins, 9-13 (1914).

The natural yellow color of cow's milk is due to two entirely different kinds of pigments. The principal pigment is the fat-soluble one which we find in butter. This is mainly carrottene, a hydrocarbon to which the molecular formula $C_{40}H_{56}$ is assigned, but contains also some two or three pigments of the xanthophyll group—oxygen compounds closely related to carrotene, one member of which group has been obtained in a crystalline state and analyzed, leading to the formula $C_{40}H_{56}O_2$.

The other kind of pigment is water-soluble and makes itself evident in whey. This is closely related to and probably identical with urochrome, the specific yellow pigment of normal urine. It is a nitrogen compound whose constitution has not been elucidated. The probable identity of lactochrome with urochrome was inferred from the similarity of behaviour towards acetaldehyde which had been rendered "active" by exposure to direct sunlight and towards bromine. In both substances the active aldehyde caused changes resulting in the development of absorption bands in the red end of the spectrum identical with those yielded by urobilin. With bromine each gave a brownish yellow precipitate whose properties were in most respects identical, but the whey yielded some additional bromine compounds which were soluble in water and alcohol. These Palmer regards as probably due to decomposition products of the lactochrome. The precipitated bromine compound, whether from urochrome or from lactochrome, responds to a test for the pyrrol group. The milk of Ayrshire and Jersey cows was found to contain a larger proportion of lactochrome than that of cows of the Holstein and Shorthorn breeds and the whey of sheep's milk was found to be in many cases more highly colored than that from cows.

The lipochrome of milk, as already stated, contains carrottene as its chief and xanthophylls as minor constituents. These were identified by study of the color, absorption spectra in carbon disulphide solution, partition between alcohol and petroleum ether, and the so-called chromotogramms obtained by filtering solutions through a deep layer of powdered calcium carbonate, a process which resulted in the formation of colored bands alternating with colorless ones. Actual numerical results were not obtained but the predominance of carrottene in milk fat was inferred, while the same methods led to the conclusion that in carrots the xanthophyll constitutes not over three or four per cent. of the total coloring matter; in cottonseed by-products, as in cottonseed oil itself, the carrottene and xanthophyll are in about equal proportions, while in yellow corn xanthophyll is the main and carrottene the minor pigment. Examination of a few samples of human milk indicated that the pigments were present in more nearly equal proportions than in cow's milk.

These pigments are not synthesized in the animal organism but are merely segregated from the food. Carrottene and xanthophylls are present in green feeding stuffs, associated with chlorophyll. It is well known that the milk of cows on fresh pasture is more highly colored than that of cows on dry feed. The carrottene is assimilated from the food in preference to the xanthophyll, partly on account of its greater stability towards the digestive juices, partly on account of its lower solubility in bile. The carrottene appears in the blood serum in the form of a chromoprotein and may be stored in the body fat for a considerable time. Jersey and Guernsey cattle have a superior capacity for the assimilation and storage of carrottene. Hence we find not only their milk but also their body fat and skin secretions more highly colored than in other breeds. Curiously enough the same pigment which creates a strong preposession in favor of their milk provokes a prejudice against their beef. The amount of coloring matter in either the milk-fat or the body fat has, however, so far as science has determined, no relation to the taste or nutritive value of the fat either in the beef or in the milk. It is interesting to recall that a primitive method of coloring winter butter was to use extract of carrots. This was putting into the winter butter the same pigment which was naturally present in the summer butter. The modern butter color, however, is usually a fat soluble coal tar dye.

Dairy chemistry presents many other interesting features both as regards methods and results, but I trust I have presented enough material to show that those working in this field are not sleeping and that substantial progress is being made in this as well as in other branches of the science.

Composition of Milk

	Average Richmond 1914	Limits: Extreme (Sherman)				Usual (Lythgoe 1910)				Herd Milk (Lythgoe 1914)			
	280,000 Samples A	Max.	Min.	Max.-Min D	100D A	Max	Min.	Max.-Min. D	100D A	Max.	Min.	Max.-Min. D	100D A
Solids	12.65	.....	....	....	...	16.0	10.5	5.5	43	14.57	11.56	3.01	2½
Solids-not-Fat	8.91	13.76	4.90	8.86	99	10.0	7.7	2.3	26	9.48	7.63	1.85	21
Fat	3.74	14.67	1.04	13.63	365	7.0	2.8	4.2	112	5.40	3.35	2.05	55
Casein.......	3.00 }												
Albumin.....	0.40 }	9.98	2.86	7.12	209	4.5	2.5	2.0	59	4.02	2.66	1.36	40
Lactose......	4.70	5.28	2.33	2.95	63	5.5	4.2	1.3	28	5.25	4.35	0 90	19
Ash.........	0.75	1.44	0.66	0.78	104	0.8	0.7	0.1	13	0.79	0.65	0.14	19
Miscellaneous	0.06												

Composition of Bran and Shorts as Milled Under the Regulations of the Canada Food Board*

By Frank T. Shutt, D.Sc., and R. L. Dorrance, B.A.

The tremendous and ever increasing demand for Canadian flour for military and civilian use overseas has compelled the Canada Food Board, in order as far as possible to meet these requirements, to issue regulations "lengthening" the milling extraction, which means that the Board has ordered the production of more flour from a given weight of wheat than was customary in pre-war times, indeed until April of the present year, the date of the new regulations.

Hitherto, it has been the practice of Canadian millers to make 196 pounds of flour from about 270 pounds of wheat —approximately 72.5% extraction—10 pounds of which flour (of lower grades) being generally used in the preparation of middlings. This resulted in, approximately, 81 pounds of offal—bran, shorts and middlings—from 270 pounds of wheat.

Under the new regulations it is required that as regards spring wheat—the wheat of the prairie provinces—196 pounds of flour shall be made from 258 pounds of wheat—practically a 76% extraction—this flour being known and sold as "Government Standard Flour." The making of feed flour, commonly known as Red Dog, and of middlings, is prohibited. The result is that about 59 pounds of bran and shorts are milled from 258 pounds of wheat—a reduction of approximately 25% in the amount of feed, compared with that made before the regulations came into force. These facts explain in a large measure the present shortage of and difficulty in obtaining bran and shorts and, further, explains why the floury, mealy middlings, so valuable in pig and calf feeding are no longer obtainable.

Fourteen years ago a collection of samples of bran and shorts, representative of the output of the leading flour mills of the Dominion, was analyzed in the laboratories of the Experimental Farm, the series affording the following data:

*Contributed from laboratories of Dominion Experimental Farms. Summary of paper read before Section III, Royal Society of Canada, May, 1818.

Average Composition of Bran and Shorts—1903

	Bran	Shorts
Moisture	11.07	10.34
Protein	14.52	15.93
Fat	4.37	5.24
Carbohydrates	54.19	59.58
Fibre	10.14	5.23
Ash	5.71	3.68
	100.00	100.00

Bran.—In this series the protein varied from 13.25% to 15.31%; the fat from 3.60% to 5.19% and the fibre from 9.28% to 10.93%.

Shorts.—Corresponding figures for the shorts were, protein 15.15% to 17%; fat, 3.98% to 6.23% and fibre, 3.82% to 7.51%.

During the autumn months of last year (1917) further and larger collections of these feeds were made and analyzed, with the following results:

Average Compostion of Bran and Shorts—1917

	Bran	Shorts
Moisture	9.51	9.81
Protein	15.09	16.03
Fat	4.38	4.97
Carbohydrates	55.73	58.04
Fibre	9.62	6.90
Ash	5.69	4.25
	100.00	100.00

Bran.—The limits of variation are, protein, 13.23% to 16.75%; fat, 3.21% to 5.49%; fibre, 7.64% to 11.68%.

Shorts.—Corresponding results for this feeding stuff are, protein, 15.04% to 18.06%; fat, 3.80% to 6.04% and fibre, 5.83% to 8.88%.

Comparing these two series, collected thirteen years apart, the differences in composition are not, on the whole, such as to call for extended comment, though in the 1917 series the higher percentage of fibre in the shorts appear to be significant of certain milling changes that have taken place during that period.

Subsequent to the coming into force of the new regulations (April, 1918) samples of bran and shorts were obtained direct from the mills of a number of the leading firms, and submitted to analysis.

Average Composition of Bran and Shorts Subsequent to New Regulations of Canada Food Board (76% Extraction)

	Bran	Shorts
Moisture	7.13	7.22
Protein	15.83	17.67
Fat	4.98	5.16
Carbohydrates	55.20	57.25
Fibre	11.51	8.52
Ash	5.35	4.18
	100.00	100.00

Bran.—The series showed the following limits: protein, 15.69% to 16.03%; fat, 4.85% to 5.09%; fibre, 11.08% to 12.18%.

Shorts.—Corresponding limits in the series of shorts samples were protein, 16.84% to 18.41%; fat, 4.77% to 5.65%; fibre, 8.23% to 9.12%.

It may first be observed that in both the bran and shorts the samples of the 1918 series show less variation in composition than those of the two preceding series, indicating the closer standardization of the milling process under the new regulations. This will be apparent from the following table.

Limits of Variation

	1903	1917	1918
Bran—			
Protein	2.06	3.52	.34
Fat	1.59	2.28	.24
Fibre	1.69	4.24	1.10
Shorts—			
Protein	2.17	3.02	1.57
Fat	2.25	2.24	.88
Fibre	3.69	3.49	.89

Comparing the composition of the bran and shorts milled under the regulations with these feeds as previously manufactured we find:

1. That the bran now made (regulations of April, 1918) is, approximately, .75% richer in protein, .5% richer in fat and contains 1.5% more fibre.

2. That the shorts under the new regulations are approximately 1.75% richer in protein, very similar in fat content and contain about 2.5% more fibre.

These results are in the direction that might have been anticipated, for the closer extraction of the floury particles (essentially starch) under the new regulations would more particularly increase the percentage of protein and fibre constituents which are characteristics of the bran costs of wheat. The greatest difference is found in the shorts, which now more closely approach fine bran and from which are absent the small percentages of low grade flour which hitherto gave them their mealy floury condition.

Bran and shorts are legally defined under the Food Adulteration Act. They must conform to the following limits of composition to be accounted genuine:

Legal Limits of Bran and Shorts

	Bran	Shorts
Protein, not less than	14%	15%
Fat, not less than	3	4
Fibre, not more than	10	8

While the standards may have been sufficiently fair in pre-regulation times, the results of our recent analyses would indicate that they are not well suited to the bran and shorts milled under present regulations. The following may be tentatively suggested, as apparently meeting these products under the new milling:

	Bran	Shorts
Protein, not less than	15.00%	16.5%
Fat, not less than	4.5	4.5
Fibre, not more than	12.00	9.00

Nothing very definite can be said about the digestibility of the new bran and shorts, as no digestion experiments have been made with these feeds, but the probability is that as far as the feeding of dairy cows and steers, etc., is concerned there will be very little difference in this regard from the pre-regulation feeds—the somewhat higher protein content may be largely offset by the larger percentage of fibre. But in the case of young pigs and calves it may fairly be concluded that the new shorts, owing to their more fibrous character, will not be so nutritious or suitable.

Nitrogen Fixation

The work of developing processes for the fixation of nitrogen is discussed at length in the new Year Book of the United States Department of Agriculture. In this discussion Frederick W. Brown, of the Bureau of Soils, speaks very encouragingly of a new process, involving the use of carbide, which appears to have advantage over the cyanamid methods, and which, through economies effected, may be able to operate successfully under American conditions.

Chemistry Committee of Advisory Council

The first general meeting of the Associate Committee on Chemistry of the Honorary Advisory Council for Scientific and Industrial Research was held in Ottawa, May 20th.

The chairman, Dr. R. F. Ruttan, Director of the Department of Chemistry of McGill University, presided and there were present the following members:

J. W. Bain, B.A.Sc., Professor Chemical Engineering, University of Toronto, Toronto.

Dr. John S. Bates, Chem. E., Ph.D., Superintendent Forest Products Laboratories of Canada, Montreal.

Dr. F. J. Birchard, B.A., Ph.D., Research Chemist, Dominion Grain Laboratories, Winnipeg, Man.

Prof. Adam Cameron, M.A., B.Sc., Professor of Chemistry, University of New Brunswick, Fredericton, N.B.

Dr. W. H. Ellis, M.A., M.B., LL.D., Dean, Fac. of Applied Science, University of Toronto, Toronto.

Dr. W. L. Goodwin, B.Sc., D.Sc., Director of School of Mines, Kingston, Ont.

Dr. F. M. G. Johnson, M.Sc., Ph.D., Chemist, British Chemical Company, Trenton, Ont.

Dr. E. A. Lesueur, B.Sc., Consulting Chemical Engineer, P.O. Box 213, Ottawa, Ont.

Dr. A. F. L. Lehmann, B.S.A., Ph.D., Professor of Chemistry, University of Alberta, Edmonton, Alta.

Dr. E. Mackay, B.A., Ph.D., Professor of Chemistry, Dalhousie University, Halifax, N.S.

Dr. D. McIntosh, M.A., D.Sc., Professor of Chemistry, University of British Columbia, Vancouver, B.C.

Dr. R. D. MacLaurin, B.A., Ph.D., Professor of Chemistry, University of Saskatchewan, Saskatoon, Sask.

M. A. Parker, B.Sc., F.C.S., Professor of Chemistry, University of Manitoba, Winnipeg, Man.

T. H. Wardleworth, F.C.S., Chairman, Canadian Branch Society Chemical Ind., Imperial Munitions Board, Ottawa.

Dr. McGill, Chief Analyst of the Department of Inland Revenue, was present by invitation; and Dr. A. B. Macallum, Administrative Chairman, and Dr. A. S. MacKenzie, member of the Council, were also present.

Dr. Ruttan gave the following outline of the work of the committee:

In September, 1915, the National Research Council of the United States was formed as an offshoot of the Academy of Science at the request of President Wilson, and Professor Hale was made its chairman. That Council is the analogue in the United States of our Advisory Council in Canada.

In England, in July, 1915, a Committee of the Privy Council, with Lord Crewe at its head as chairman, was established for the same purpose, and associated with that was an Honorary Advisory Council of men of science under the chairmanship of Sir Wm. McCormack.

Now, in Canada, a very similar line of action followed, and June, 1916, a Committee of the Privy Council was formed with the Rt. Hon. Sir George Foster, as chairman, and the Hon. the Ministers of the Interior, Agriculture, Mines, Inland Revenue and Labour were added to form this Committee of the Privy Council. The position of the Honorary Advisory Council is that of an advisory body in connection with this Privy Council Committee and this Advisory Research Council was created by order-in-council on the 29th day of November of that year. The members of it you know, and I need not recite them. Our Council was, last August, incorporated by a special act of Parliament through the efforts of our efficient chairman and a copy of the act has been given you by him.

The Advisory Research Council of the United States took their labors very seriously, and, as they attack most matters in the United States, they began by a very systematic and elaborate organization. In fact, the whole work of the National Research Council was so thoroughly organized and there were so many wheels within wheels, that the friction was so great very little work was actually accomplished, and the recent movement has been a readjustment to simplify the original complex organization. When I tell you that there were four hundred members of the Chemistry Committee alone, you can form an idea of how complicated matters were. Indeed, the subject of chemistry was divided up into all the different branches of the science with representations on their Chemistry Committee, and this again was subdivided and each section of the country was represented so that the chemists on that Committee were the leading chemists of every branch of science from Maine practically to San Francisco. This was found to be too complicated,and the organization is now much simplified.

Now, having that horrible example before us, we have decided on a very simple organization in connection with the Advisory Council. We have six standing committees, and these are the Standing Committee on Finance, Publicity, Studentships and Fellowships, one on Organization and one on Assisted Researches.

Let me first briefly consider our activities. There is probably none which is more important in developing research than our system of studentships and fellowships. As the name studentship implies, it is not for the purpose of putting a young graduate at chemical research which is to lead to great results, but is to take a young man with an aptitude for research, with a certain amount of initiation and resourcefulness, who knows his work, and putting him into research—training him into research. Now it has been said that we are making a great mistake in putting these young graduates on industrial research problems. We have been criticized in the press very much for that. As a matter of fact these studentships are for the purpose of developing research men. One of the conditions under which these studentships are held is that this student shall devote himself to research work, attend lectures in advanced courses, and that he obtain, if possible, a higher degree.

Now Fellowships are quite different. Fellowships are given only to men of a very much higher qualification than has been shown by those who take studentships. Fellows are usually required to present a research which they are qualified to solve and this should be of value to the industries of Canada. The question of organization brought up the Organizing Committee. I may say that it had to deal with the important problem of finding out what research there was in Canada, what were our resources in material and men in the country, and the result was that a large number of questionnaires, (I think in the first issue to manufactures there were some 17,000 and since then I imagine there has probably been another 10,000 gone out), were sent out, in order to find out our present status, and then from that possibly to build up something for the future. Now this is much too large a question to take up in detail. The results were on the whole disappointing. Very little scientific method was found in our chemical industries and research was found to be carried on chiefly in the universities. The Assisted Researches, I shall refer to more in detail later on.

The Associate Committees are those on Chemistry, on Mining and Metallurgy, the B.C. Committee and a Committee on Forestry. The Mining and Metallurgy Committee is analogous to our own Committee. There are some twenty or twenty-two members of that Committee from the different provinces. They have already had their initial meeting in Montreal some time in April last.

In addition to these committees, committees ad hoc have been formed when questions of importance come up. The committee on a special subject works it out as fully as possible, reports to the Council and is discharged.

There is one now on Cold Storage, dealing with the best methods of cold storage in association with a similiar committee in England. The question of Flax Fibre and its development in Canada was studied to try to obtain twine or cordage from Western flax. We have one on Power, watching the development of water and electric power, particularly in its application to chemical industry, both on the St. Lawrence and in the

remote districts of the North. Then, we have committees on Plant and Animal Diseases, which have to do chiefly with conditions in the prairie provinces. One on Phosphates and Potash, which is really connected with this particular committee, and will be referred to. One on Nitrogen Fixation, and which is associated with the British Inventions Board, and one on Lignite and that committee has finished its work. Up till about eight or nine months ago, this question of lignite and its importance as a source of cheap fuel for the middle provinces was one which we took up with a great deal of our time and energy at the very beginning of our work. Mr. R. A. Ross was chairman of that committee with Dr. Adams and President Murray as members. A very thorough investigation was made with regard to everything that had been done and was known on the subject up to the present time. Experts were sent to investigate methods of briquetting and of handling lignite in various forms, and where briquetting was done and lignite treated in preparation for fuel. Estimates were obtained of the cost of machinery, installation, and calculations made as to price per ton, for which lignite briquettes could be sold in the various towns in the West from Winnipeg through to Regina. This then was very carefully worked out and as far as possible on the conservative side, and the opinion was that the proposition was not only promising but very promising. We went to the Minister of Finance and asked for $400,000 to establish the industry on a very small scale, and the suggestion was turned down. We were told there was no emergency re the coal question, that this was not a war measure and that $400,000 was a very great deal to ask for a proposition of this sort. We all regret that this matter was not undertaken more than a year ago, when first proposed.

The matter has recently, I may say chiefly through the energetic work of our chairman, Dr. Macallum, been recommended by the Government. It has gone through in this way, that the Provinces of Manitoba and Saskatchewan and the Dominion Government are sharing expenses between themselves. A Commission of three engineers will take charge of it. This Commission will have entire power regarding organization and equipment, engagement of help and other assistance necessary to carry out. Mr. Ross, member of this Council, is going to be one of the Commission and we have every confidence that in the near future briquetted lignite will be an economic substitute for anthracite in domestic use throughout the Eastern lignite district.

This gives you a somewhat rough idea of some of the activities of this Council, and I shall call the attention of the members of this Committee a little more particularly to two in which we, as members of the Chemistry Committee, are especially interested, but first I would like to refer to the Assisted Researches which have been going on this year.

As you know, special grants in aid of researches may be obtained from the Advisory Council. Two of these have been allotted. The first went in aid of an investigation of Tar Fog, by Dr. J. G. Davidson, professor of Physics in the University of British Columbia. The Council recognized the national importance of obtaining economically products of distillation of wood and coal and any process which would help to separate the liquid products from the gaseous ones would be of great economic value. Dr. Davidson was to try the application of the Cottrell process of condensation of vapor and solids in the presence of gases to conserve the tar materials which are the result of the destructive distillation of wood and coal before the distillate has cooled down to such a temperature that the water is deposited. In other words, to make a preliminary separation of the tar from the steam and the gases so that when the steam and ammonia are condensed we would have a clean product, as the tar is almost completely removed by a process that is very much simpler than the ordinary recovery plan.

Dr. Davidson has been working on this all winter. He has had a unit installed at Sault Ste. Marie, and he has had a great many difficulties, but he has established the fact that we can u e the Cottrell process for the recovery of tar under these circumstances. He found that the ordinary methods of insulation of the wire which carries the charge perfectly useless. The substances like porcelain were absolutely no good and would only stand up for some few hours. Even silica tubes were not absolutely efficient. He had to make certain changes in them so that the surface was quite smooth, otherwise accumulations of tar would cause short circuiting.

He also found that a special protection was necessary at the point at which the charged wire left the silica insulation, as in a very short time the wire burned through at the conjunction of the wire and silicon. The finely divided carbon as smoke deposited on the silica and caused short circuiting. He found that in order to prevent this the temperature about the silica insulations had to be kept high by heating coils at each end of the condensing tube. The use of silica as an insulator and heating coils to prevent the deposit of carbon have made this process of condensation of tar fog a commercial success. There is another research being carried on by Professor MacLaurin, which he will tell us about, in connection with the utilization of straw for the production of gas for heating the farm houses of the Western Plains where straw is burned in thousands of tons as refuse.

A grant was made, also, to Professor King, for experiments in connection with the fog signal apparatus in the Gulf. He had associated with him Professor Millar, representative of the American Navy and of the department of Naval Service in Canada. Professor King's work last summer was of great importance in the development of fog signalling, as he developed a method of standardizing sirens and other fog signals and showed how it was possible to reduce the great waste of energy now used in the production of fog signals.

A small research was undertaken on the study of the separation of nicotine from Canadian waste tobacco. This was handed over to me and I got the services of Mr. Arthur D. Hone, who worked in the University of Toronto in Professor Lash Miller's laboratory. He determined the nicotine value of the various forms of waste tobacco which we have in Canada, such as in leaves, stems, etc., of the refuse tobacco generally. This is at present imported as nicotine sulphite, strength, 40%, and is most valuable as an insecticide for aphides on fruit trees. It was sold in Canada at $1.25 a pound. There were upwards of 200,000 pounds of waste tobaco in Canada selling at from ¾ to ½ cents per pound when the research began.

The result of this work, to put it briefly, is to show that if any person had bought up the Canadian waste tobacco they would probably have made a fortune, as the amount of nicotine is very much more than sufficient to give a large profit and, in addition, there is 7% potash, all of which can be recovered. Mr. Hone has completed his work and it will form a special pamphlet which will be sent out in a short time. Unfortunately, there is no waste tobacco now. We all know that all the stems are carefully split very fine when put in the tins of tobacco, and there is twice the ordinary amount of dust, so that we know, by looking into our tobacco tins, that there is no waste tobacco. Material now sold as waste tobacco is now worth 15 cents, so that it is out of the question to recover nicotine now. Under normal conditions we can probably recover nicotine sulphate from it.

Dr. Davis, of the University of Manitoba, under Professor Parker, has been engaged in research in determining the vapors in gases from destructive distillation of coal; that is, determining the amount of benzol and toluol during the process of destructive distillation of wood coal and in the manufacture of producer gas. He has published three papers and has devised a very valuable instrument which has been made by order of the Imperial Munitions Board and sent over to England, and is now being

used there for determining the quantity of vapors in gases. This instrument has been tested very largely in Winnipeg and is now being applied in Sault Ste. Marie on a large scale. Two of three papers have been published on this research.

(2) Estimation of benzine and toluene light oil contained in gases.

(3) Study of the absorption of light oils in gas.

It is particularly on this last paper that Dr. Davis is conducting his research, and has obtained some very useful data indeed in regard to methods of economically absorbing benzine and toluol.

There is another experiment being carried on by Professor Porter, of McGill, which consists of the application of the principle of flotation to new ores, particularly certain economic ores from British Columbia. He is using Canadian refuse oils from distillation of hard woods.

The amount and character of the sugars in sulphite liquor waste was another research which I got Dr. Kreible to carry out. He found that the liquor from our Canadian mills gave as good results as those used in Europe and the United States as sources of Ethyl Alcohol. He found 67% of the total sugars were fermentable, and the total sugars ranged from 1.2 to 1.96 grammes per 100 c.c. He also made a study of the best conditions for carrying on the fermentation.

There are two other researches which have only just been started. One by Professor W. P. Thompson, of Saskatoon, on the genetics of wheat. He has been working for some years on an improved variety of wheat. He has probably got a variety which is rust resisting, and working with a view to developing this particular kind of wheat so as to obtain it in an early maturing form.

Another research is being conducted by Professor Stansfield, of McGill University, re the study of the reduction of low grade ores by means of gas. The idea being, that it is possible to reduce certain ores at comparatively low temperatures in reducing gases. This would lead to the production in small units of iron which could be finished by a small electric furnace. The establishment of very small units throughout Canada to recover the low grade ores would be of great national importance.

Now, gentlemen, I would like to refer to the problems that have come before the Associate Committee on Chemistry. We have had a large number of problems, and have had a large number of questions. We have no fewer than eighty-seven questions that I would ask you to glance over to see what kind of questions are sent in, to which answers have been given by myself and other members of the committee.

All sorts of things have been enquired about, more or less chemical, and a great many of these require quite a little research in order to answer them properly. Now this is due to a mistake regarding the nature of the Advisory Council. It is an Advisory Council, but not an executive body. Nevertheless, we have unfortunately had to act frequently as an executive organization and we have had a great deal of work in answering questions and trying to thus develop confidence in the value of the Council and create a public opinion in favor of research. There is the very important study re potash salts in Canada and the possibility of increasing the output. This was a very large question a year ago, and, as you know, the papers and scientific journals had all sorts of wild cat schemes for obtaining potash on a large scale. Numerous enquiries were sent to members of the Council and, as a result, a very complete synopsis of literature on the subject was compiled with the aid of the Department of Mines.

The Chemistry Committee went very carefully into the question of obtaining potash from feldspar, but we are unable to state at the present time that there is any process going on in Canada where potash is being obtained economically from feldspar, in spite of announcements in the papers to the contrary. There is one process which is commercially a success as far as it has gone and that is hydrolysis of potash feldspar by means of lime and steam at a high pressure. This is being worked in New Jersey and on the Hudson River. The valuable product is a very high grade of brick for exteriors of high buildings, as its crushing strength, resistance to heat and hardness is better than other bricks and about 6 to 7% potash is a by-product. It has been found that glauconite gives a better yield of the brick making material and a better yield of potash than can be obtained from feldspar. This company is now utilizing the green sands of New Jersey for the manufacture of these bricks, and potash. A recent report which comes from British Columbia is that they have found a bed of glauconite in British Columbia, probably Dr. McIntosh knows of it. If true, we will be able to utilize it for obtaining potash. The same thing was found in connection with the ash from straw. In each case the combustion is too rapid that the draught carried away the most of the ashes. Condensation of potash salt from vapors of cement works has been a source in the United States, and one firm in Montreal, Canada Cement Company, has introduced a few condensation pipes for experiments. Analysis of this material used in this plant justified the expenditure necessary to install a Cottrell system. There is no reason why analysis should not be made of the flue dust of all our large cement works through the country, and many, I am sure, could produce sufficient potash to justify the Cottrell Process. A good deal of potash is now coming in Canada from hard wood ashes. The old industry of collecting these ashes and leaching them for their potash has been renewed in some of the cities, but how much is resulting from this source cannot be estimated. Glauconite, as you know, is worked in England simply for its potash. We also found that the ashes left in the waste wood burners of British Columbia gave only a trace of potash. Some investigations are being carried on in the Kingston school for mining regarding the use of nepheline cyanite. This rock contains 4 to 5% potash. Progress is now being made in preparing a fertilizer from this rock. I am not sure whether it is a commercial success or not. Every encouragement had been offered those who are investigating methods for obtaining potash from feldspar. So far, there is no proof that any of these processes are commercial. This is a very big problem at the present time. As you know, one of the great problems in Canada is obtaining fertilizer, and we are looking in every direction to obtain material which will induce more intensive farming and give a larger yield from the farms. Of all the sources of fertilizer, one which seemed to us as of outstanding importance is refuse from the fisheries, popularly known as fish waste and waste fish. At a conservative estimate there is upwards of 300,000 tons of fish waste for use in Canada. It is not only possible to obtain a valuable fertilizer with a high nitrogen and phosphate content, but quite possible and economical to produce protein food for cattle and hogs, as well as for poultry from fish waste. A certain amount of data has been sent in by Dr. McIntosh, on the Pacific coast, and Dr. Mackie has reported regarding New Brunswick, Nova Scotia, and especially Cape Breton, and as a result from the information obtained from the Department of Marine and Fisheries, we have sent Mr. J. B. Feilding to make a preliminary port survey of Nova Scotia and Cape Breton as well as Gaspe, with a view of finding out how much fish waste is available and whether it is within hauling distance of centres where it could be readily converted. The West coast is different. There fishing is periodical. It is continuous in parts of Nova Scotia, Canso particularly, all year round. It seems to be much more feasible to establish a plant in the East than in the West. Considering that the present price of protein is $2 per unit, and ammonia is at $6.40, and oil is very high at the present time, $1.00 to $1.10 per gallon, it seems that the undertaking should prove a profitable one and we hope to get started during the coming season.

Chemistry in the Pulp and Paper Industry

By J. N. Stephenson, Editor Pulp and Paper Magazine

The pulp and paper industry of Canada is the third in the relative value of exports and may soon become second. It is an industry based more definitely on chemical principles than many chemists and manufacturers seem to realize.

In the first place there is the efficient utilization of fuel and the proper purchase of many materials. There is the analysis of raw materials, clay, sulphur, limestone, soda ash, dyestuffs and even the analysis of the fundamental fibre materials—wood and wood pulp.

In the mill, chemical control is necessary for effective operation, and chemistry is practised in testing the water; making size emulsions; determining the proper amount of alum; the proper quantity and kind of dyestuff; relating the moisture of the paper to the character of the finish, and in coating mills there are numerous problems connected with the use of adhesives, coating materials, and processes of coating, drying and finishing.

In the pulp mill the need of chemical control is perhaps more obvious than in the paper mill for the process is more distinctly chemical and begins, once the wood is chipped, with the chemical re-action by which the sulphur dioxide is made by the burning of sulphur. And here the first chemical problem appears in preventing the formation of sulphur trioxide or the sublimation of sulphur, either of which would cause losses and troubles. Then comes the chemical action involved in preparing the solution of calcium bi-sulphite, carrying the largest possible excess of free sulphur dioxide, and following this the most important but most perplexing problem of all, the action of the cooking liquor on the wood. Here is a series of subjects of the greatest fascination for the research chemist and problems whose solution is of vital importance to the progress of the industry.

The constitution of wood itself is by no means thoroughly understood nor even that of the comparatively pure product which we call cellulose, and when these problems are solved we will still have to deal with the enormous quantities of waste materials that pass into our streams with the waste liquors from the digestion of wood.

Some of these are already being recovered as alcohol, tanning material, etc., while from the spruce turpentine collected from the relief, Americans are making T.N.T.

This is but one phase of Canada's wood pulp industry. There is also a small amount of pulp by the soda process and a large and growing amount made by the sulphate process, both of which have their problems. The need for the chemist in the sulphate mill will be understood when it is known that men have been killed by the gas produced, due to the incorrect use of nitre cake which was being substituted for salt cake. The preparation of the cooking liquor, its action on the wood and the recovery of by-products, among the possibilities of which are turpentine, acetone and methyl alcohol, might be mentioned as a few of the problems calling for the chemist.

Canada's superiority in the pulp and paper field lies in maintaining a high quality, producing a material of constant uniformity and in the development of new products or products not now produced in Canada but imported and which ought to be manufactured at home for home consumption if not for export. To maintain these factors in successful industry requires the direction of the work by trained chemists on scientific principles. It requires the support and co-operation of intelligent workmen and the industry requires and deserves the encouragement of enlightened governmental policy. In the first place the universities and other scientific laboratories encouraged and supported by such an organization as the Advisory Council of Scientific and Industrial Research should provide the necessary trained leaders both for control of factory processes and the investigation of problems of manufacture and utilization.

The intelligent workmen must be provided through an efficient educational system designed to meet the needs of the industrial community and this deserves the full support of the Provincial and Dominion Governments. The third desired result should be accomplished by such meetings as this, where representatives of the Government have an opportunity of meeting those who are engaged in manufacturing enterprises of a chemical nature. With the government thus awakened and advised we may hope for more consideration of the importance and the needs of our chemists and their industrial expression. Without chemists, Canada's natural resources would be undeveloped.

We have just scratched the surface of the chemistry of the pulp and paper industry. There are yet many problems of fascinating interest. We must not worry about what Germany, or England, or anyone else has done. We have work here of our own. Let us "go to it."

Manufacture of Ferro-Molybdenum

By J. W. Evans, Tivani Electric Steel Company, Belleville, Ont.

The first commercial Ferro Molybdenum made directly from Concentrates in Canada, was on March 13th, 1916, at Belleville, Ontario. The Molybdenite Concentrates were mixed with lime and coke and charged into the electric furnace without previous roasting. The resulting Ferro contained 40% Molybdenum and .038% Sulphur. Since that time some 100,000 lbs of 70% Ferro has been turned out at the Plant of the Tivani Electric Steel Company at Belleville for the Imperial Munitions Board.

The Company had two Electric Steel Furnaces at their works. One a two phase tapping furnace with two electrodes passing through the roof, an electrode in the bottom of the furnace acting as the common return. The other a tilting furnace, of one ton capacity, also two phase, with the common return electrode passing through the roof, so that although a two phase furnace it has three top electrodes. It was in the first mentioned furnace that the initial run of Ferro was made.

The Tilting furnace was tried for making Ferro; but after a continuous heat of 36 hours, which would have melted several tons of steel, the Silica brick roof dropped down like wax, and upon examination of the charge, it was found that the upper surface only was melted, unaltered concentrate and lime were found a few inches below the surface.*

A new type of furnace was then designed, which successfully solved the problem, and after various changes were made in the bottom electrode, gave satisfactory results.

It was considered good work in the initial stages if we got out 100 pounds of Ferro in a 10 hour heat. Since that time we have steadily increased the output, until today we often get as much as 1050 lbs of 70% Ferro during a run of 24 hours.

Like every new industry, we have experienced many trying and discouraging results, but there is a certain satisfaction in getting over difficulties which more than compensates for the trials and tribulations.

Furnaces

The furnaces used at present are single phase and require from 3,000 to 4,500 amperes at 50 volts. There are 6 of these furnaces at the Tivani Plant.

Furnace Construction

The outside shells are built of heavy boiler plate in the form of a cylinder, open at both ends. A series of three quarter inch holes about 12" centres are bored in four rows to allow the gases accumulated within the shell to escape. These shells stand on concrete foundations having a trough from the outside of the shell to the centre, in which is placed the connection for the bottom electrode and water pipes for cooling purposes.

*The temperature required for smelting molybdenite concentrates is greater than required for the melting of platinum, possibly over 1,900° C.

The lower electrode is made of a bronze or copper block 8 × 8" × 2½ thick with a water jacket. Iron rods ¾" diameter are threaded into the block and project up from 6 to 8 inches into the bottom of the furnace.

The block is bolted to a heavy copper strip which extends outside the shell and to which an aluminium plate, connected to the cables, is fastened.

At one time we used heavy carbon blocks for the bottom electrode which extended outside the shell 12" and to which the cable connection plates were secured; but they caused considerable trouble due to heating and arcing, and were discarded.

Furnace Linings

The furnaces are lined as follows: immediately inside the furnace shell is a layer of heat insulating brick, or common red brick, then a layer of fire brick, inside this a layer of Silica brick and inside this layer, the carbon lining.

After the brick work is in place and dried thoroughly the furnace bottom is rammed about the lower electrode while hot, this consists of coke and tar heated in an iron ladle, it is built up carefully in layers and rammed as much as possible. When 12" above the lower electrode and up to the tap hole, it is alowed to set and the collapsible form is put in and the lining continued up from the bottom to the top, working round the form, keeping the lining as level as possible while ramming in place, one bucketful at a time, until filled to the top of the brick work, plugs being inserted in the tap and slag holes.

We vary this construction somewhat by putting in large pieces of waste carbon from the electrodes, when we have them, and continue the bottom out through the tap hole to the furnace shell which makes a sound tap hole, but the rammed lining answers admirably. After the lining is completed, it is left 24 hours to set, and the form is removed, the tap hole is trimmed and the furnace filled with coke and burned out for two days; the furnace is then cleared out and is ready for the initial charge of 100 lbs, this is tapped when ready, and the regular charge of 450 lbs is then added in two lots and the furnace run steadily tapping every four hours.

Electrodes

The electrodes used are 6" Graphite and 10" Carbon. We also use 12¾" by 13¼" carbon electrodes. The consumption is practically the same in cost.

The amount of carbon used is greater per 100 lbs of Ferro; but the cost is less per pound. Careful account of the weight used in both carbon and graphite shows practically the same electrode cost. The 6" graphite electrodes last 24 hours, weigh about 80 lbs and will turn out 1,000 lbs of Ferro in that time. The 10" carbon electrodes last for 50 hours, weigh about 260 lbs and turn out 2,100 lbs of Ferro. The electrodes carry from 3,500 to 4,500 amperes at 50 volts.

Furnace Charge

The furnace charge varies with the grade of concentrates. A 75% MoS_2 concentrate carrying 9% iron will yield a 70% Ferro if the charge is made up as follows:-

Concentrates	100 lbs.
Lime	120 "
Coke	10 "
Scrap Steel	5 "

Analyses

The concentrates are assayed for MoS_2 and Iron. The Ferro for Sulphur, Carbon and Silicon. The methods of analyses used at the Tivani Laboratory are given at the end of this paper. Sodium peroxide fusions are used on the concentrates with lead acetate solution titration, a weak tannic acid solution as an indicator. While the Ferro is treated with 1.20 nitric acid the iron precipitated with sodium hydrate and lead acetate solution titration.

1050 lbs of metal in 24 hours does not sound a large output; but when one considers that a 75% Ferro is worth $3.00 per lb, $3,150 is a fair day's work for one unit, employing 5 to 6 men on day shift and 3 men on night.

After operating for nearly two years making 70% Ferro on the following specification:

Molybdenum	70%
Sulphur	4%
Carbon	4.0%

The average of all the analyses on the 100,000 lbs has been

Molybdenum	70.43%
Sulphur	.38%
Carbon	3.56%

Analysis of Ferro Molybdenum

Sulphur determination. Two grams are taken for analysis, treated with 4 c.c. bromine water and 6 c.c. carbon tetrachloride in a 400 c.c. beaker (Griffin). Cover with a watch glass and stand in room temperature for 10 minutes agitating occasionally; add 15 c.c. of concentrated nitric acid. Let stand for another 10 minutes, then place on a hot plate and raise the temperature gradually, keep at this point until all is in solution, then evaporate slowly just to dryness, add a small pinch of sodium carbonate and take up in 30 c.c. of concentrated hydrochloric acid. Again evaporate to dryness and heat slowly from 1 to 2 hours to dehydrate the silica. Take up in 20 c.c. of concentrated hydrochloric acid, dilute with hot water to 85 c.c. and filter the clear solution into a one litre beaker, wash well with hot water, cool the filtrate and dilute to 700 c.c. To the cold solution add slowly 15 c.c. of a 10% solution of Barium Chloride.

Decant the solution through an ashless folded, 11 c.m. filter, wash the precipitate in the beaker with a little warm dilute hydrochloric acid, (one of acid to 3 of water) finally transfer the precipitate to the filter and wash well with warm water.

Place the filter with the precipitate in an alundum crucible in muffle and ignite and weigh. If the solution becomes cloudy before adding the Barium Chloride solution, clear with a drop or two of hydrochloric acid.

Carbon Determination

Burn two grams of finely divided Ferro in a stream of oxygen in the combustion furnace using 4 grams of red lead mixed with the Ferro, if the Silicon is high.

Silicon. The silica from the first filtration in the sulphur determination is burned, the residue is fused with sodium carbonate and a little potassium nitrate in a platinum crucible. The melt is dissolved in water, made slightly acid with hydrochloric acid, evaporated to dryness taken up in water and a little hydrochloric acid, filtered and washed. The filter is placed in an alundum crucible and ignited in the muffle and weighed, this residue is placed in a platinum crucible, hydrofluroic acid and a little sulphuric acid added and evaporated to dryness. The difference in weight being Silica, this is calculated to Silicon.

Molybdenum

Half a gram of Ferro is treated with 50 c. c. 1.20 nitric acid, heated till all is in solution, diluted with water and caustic soda added to precipitate the iron, the solution is brought to the boiling point, carefully stirring to prevent bumping, and is allowed to stand until the precipitate settles; it is filtered washed with hot water and the filtrate transferred to a half litre measuring flask, cooled to room temperature and made up to the half litre mark. 100cc of this thoroughly mixed solution is taken in a 100 cc pipette placed in a 300 cc flask a small piece of litmus paper added and hydrochloric acid added until just acid, then ammonia added until just alkaline, and then acetic acid until just acid, the solution is heated to boiling, and titrated while hot with a standard solution of lead acetate using a dilute solution of tannic acid as an indicator.

Standard lead acetate solution is made by dissolving 15.7 grams lead acetate per 1,000 cc water, this is standardized against a Ferro of known Mo content.

Fuse one gram of Concentrates with 25 grams potassium bisulphate in a covered fused quartz crucible in a muffle at a temperature of between 900 and 1,000 C. When fused place crucible in a 600 cc beaker, cover with hot water and bring

slowly to boiling point. When all is in solution, rinse crucible and cover and precipitate iron with caustic soda, bring to boil and filter through folded 15 c.m. filter into a 600 c.c. beaker. Wash four times with hot water, transfer filtrate to a 500 cc measuring flask, cool and dilute to mark, shake well and withdraw 100 cc's, transfer to a 300 cc flask and make slightly acid with hydrochloric acid, then slightly alkaline with ammonia, and then slightly acid with acetic acid, heat to boiling, and titrate with lead acetate solution using dilute tannic acid as indicator. The color will change from a deep orange to a colorless drop, read the last trace of color. Dissolve iron precipitate in hot dilute H. cl. reduce with stannous chloride, and titrate iron with potassium dichromate solution. Time 55 minutes.

Titaniferous Ores of Canada

By Dr. W. L. Goodwin, Dean of Applied Science, Queen's University*

It is a well known fact that Canada is not strong on iron ores, and that, so far as present investigation goes, we cannot depend upon our native ores for a very large output of iron, but on the other hand, we are particularly interested in the titaniferous ores. At Baie St. Paul, Que., there are enormous deposits, not very high in iron, perhaps 40% or so, but high in titanic acid, and in other parts of Quebec there are also large bodies of this ore. Eastern Ontario has deposits of titaniferous iron ore which would aggregate over a million tons, so far as we have knowledge of them, and in Western Ontario, in the Rainy River District, there is a range of this kind of ore some ten miles in extent, and the quantity must be exceedingly large. Now the discussion of the production of iron from these ores hardly comes within the scope of this Committee, as a Committee of Chemistry. This has already been discussed by the Metallurgy Committee. We can dismiss it with the statement, I think, that the difficulties which have been met in the past in the use of these ores are now pretty completely overcome in the hands of those who have worked with them, such men as Rossi and Bachman; difficulties which to some extent at least have not been due to the character of the ore, or to the impossibility of working them economically, but rather to lack of knowledge and unfamiliarity with the best method of working such ores. Doubtless other difficulties which have been ascribed to the titaniferous ores were simply the ordinary accidents of blast furnace practice. That, perhaps, may be taken as a rough summary of the situation, although I would not like to say dogmatically that the troubles which have been met with are all of that sort.

Titanium and its compounds and alloys are of very considerable importance to chemists and to chemical industries, in addition to their well known importance in metallurgical industries. In the latter, ferro-titanium is coming more and more into use as a scavenger in the manufacture of steel, to free the metal from nitrogen which in a certain way affects its strength. We are more particularly interested in the compounds of titanium, a number of which are of growing importance in the textile and leather industries; and, in the opinion of those who have paid most attention to them from this standpoint, the only reason why they are not used more extensively in these industries is because of the difficulty of procuring large enough sources and of a good enough process for manufacturing pure titanic acid, particularly free from iron. It is the work of this Committee to solve, or to suggest work along the line of solving, such problems as these. The utilization of these ores from thatstand point might strike along several different lines which have been fairly well worked out. One of these has been pointed out in connection with Dr. Stansfield's investigations on the poorer iron ores; viz., to partially reduce the ores by means of gases. It has been shown that, under right conditions, titaniferous iron ore can be reduced by gases at temperatures below those at which pure iron melts, but high enough to fuse the gangue matter, which, including the titanium acid can then be run off from the solid iron. This has not yet, so far as I know, been worked out on a commercial scale. But the known facts show at least the possibility of getting—as one product iron of high quality and when it is made from ores containing, say, 25% titanic acid,—a slag which can be directly used for the manufacture of titanium products.

As is well known, a number of titanium salts are used in dyeing textiles and leather. For these and other purposes, as already said, titanium products would be much more largely used, if a large supply of pure titanic acid were available. At present the principal source is rutile, which is concentrated from a rock containing only four or five per cent of mineral. This concentrate is nearly pure titanic acid, but a very much greater source would be tapped in our titaniferous iron ores.

At Niagara Falls, where the company organized by Mr. Rossi is working, I believe, the titaniferous iron ores are used after being concentrated by a process which is probably magnetic concentration. A concentrate is obtained which is sufficiently high in titanic acid for their purposes. Now it seems to me that we have here one field for investigation to bring this ore of ours into more general use.

These ores usually contain a very small quantity of a very valuable metal, vanadium. In reading in a German journal the other day, I came across the fact that the discovery of vanadium centred around a certain iron slag, which at an earlier date was noted to contain something peculiar, and this slag was derived from certain iron ores from Luxemburg. In a recent number of "Stahll und Eisen" it is stated that the Germans are at present extracting their vanadium for use in preparing strong steel for their munitions from an iron slag containing not more than 7/10 of one per cent. of that metal. Now, that suggests possibilities. We have shown in our laboratory that it is possible, by varying the conditions, to cause vanadium to go into pig iron or into the slag, whichever we choose. This can be done by varying the amount of reducing material and the nature of the flux. The time factor also comes in. While the amount of vanadium is small, usually one or two tenths of one per cent., considerable bodies of ore have been found containing as high as seven tenths of one per cent. or even higher in some samples. It should be possible to smelt such ores so as to give a pig iron containing from 1½% to 2% of vanadium. There is here, then, the possible source of a very valuable material.

*From an address before the Chemistry Committee of the Honorary Advisory Council for Scientific and Industrial Research.

War Conference and the Dye Industry

An official summary of the proceedings of the Imperial War Conference, held in London in July, and attended by the Canadian Premier, has been published.

One resolution dealt with the action taken by the British Government to free the dye industry from dependence on German dyestuffs and recommended other Governments of the Empire to consider immediately what steps can be taken to co-operate with the Imperial Government in developing the dye industry in the British Empire, and so avoid enemy domination over essential industries.

The conference also considered the question of Imperial communications, and accepted in principle the establishment of an Imperial investigation board to deal with the question of ocean freight rates, the control of shipping and the better co-ordination of rates on parcels within the British Empire.

It is reported from Stockholm that the Swedish Government has made comprehensive tests of a substitute for copper in carrying electric currents, including telegraphic and telephonic messages. The discovery, reports of which have come from Germany for some time past, may have far-reaching effects on the copper market. The method consists in intertwining iron and zinc wires in various ratios according to the distance the current must be carried. No copper is involved.

Industrial Alcohol—Its Manufacture in Canada

One of the subjects discussed at the meeting of the chemistry committee of the Hon. Advisory Council for Scientific and Industrial Research was that of industrial alcohol, Dr. J. S. Bates and Mr. Theo. H. Wardleworth leading in the discussion.

Dr. Ruttan, chairman of the committee, in opening the discussion, said there was little doubt that alcohol could be produced from the sulphite liquor of pulp mills in Canada at a profit under present conditions, but the extensive commercial use of it would depend on the Imperial Munitions Board.

Dr. Bates said that investigation of the manufacture of ethyl alcohol from sulphite liquor and of toluol from sulphite turpentine has been centred to some extent in the Forest Products Laboratories in Montreal. The processes are already known and are being carried on in other countries.

The sulphite pulp industry in Canada makes 1,000 tons of sulphite pulp per day, and is rapidly increasing. Organic matter in the waste sulphite liquor is equivalent pound per pound to the sulphite pulp production, being 50% of the original wood. The total amount of sulphite liquor is over 2,000,000 gallons per day and the organic matter in the liquor is approximately a 10% solution of solids. The total sugar amounts to approximately 2% by weight of the liquor, of which 65% is fermentable. The alcohol value by fermenting amounts to 0.7% by volume of the liquor actually recoverable. This process is already established in Norway, Sweden and Germany; largely since the outbreak of war, due to the necessity of conserving food materials. Alcohol is used for motor fuel, since petroleum products are expensive in Europe. There are two plants, I think, in the United States, neither very large, but successful at present time on account of the high value of alcohol. The Imperial Munitions Board required a large amount of alcohol in connection with nitro cellulose manufacture, and import a large proportion of alcohol from the United States. Two of the large sulphite pulp manufacturers in Canada have gone into the question thoroughly and will go ahead with commercial development if they obtain a contract for sufficient length of time to warrant expenditure for plant.

The process itself is fairly simple, involving the neutralization of the small amount of free acid in the waste liquor and distillation of the alcohol from this dilute solution. The disadvantage of the process is, that the sugars in the waste liquor run only 2% of the waste liquor. The process is practical and can quickly be established in Canada. It will conserve food, since corn and molasses are both consumed in alcohol manufacture. In discussing commercial development with the pulp and paper plants, the Imperial Munitions Board and War Trade Board, one disadvantage seems to be that the normal demand for alcohol in Canada is so small. This is partly due to the excise tax on alcohol, and without "duty-free" industrial alcohol there can be but little hope for extending the use of alcohol in this country.

The factors affecting the disposal of alcohol in Canadian and foreign markets are not thoroughly understood by pulp and paper manufacturers, naturally, and we would like the advice of this committee or reference to other authorities regarding the economic phases of the whole question.

With regard to toluol from sulphite turpentine in the sulphite pulp process, the turpentine in the wood is apparently largely converted into cymene. It is possible for each mill to install recovery apparatus for $100 or $200. The average yield is 0.75 U.S. gallons per ton of sulphite pulp produced and there are 1,000 tons or more of pulp per day manufactured in Canada.

The crude sulphite turpentine consists of from 80 to 90% true cymene. By shipment of this crude cymene to a central conversion plant it is possible to treat the crude cymene with aluminium chloride and hydrogen, in order to convert cymene into toluol. The process is already established in the United States, there being one plant in Philadelphia, which may be taken over by the United States Government in connection with their toluol programme. The yield of toluol is roughly 0.45 U.S. gallons per gallon crude cymene. From the available sulphite mills in Ontario, Quebec and New Brunswick, the amount of toluol obtainable would be something like 100,000 gallons per year. The pulp and paper companies are quite ready to install this simple recovery apparatus, and sell their sulphite turpentine at their plants, delivered in steel drums at say 10 cents per gallon. The establishment of a toluol conversion plant is now under consideration and further investigation of commercial factors will determine the course of action.

Mr. Wardleworth said the question that has been raised by Dr. Bates has been receiving a considerable amount of attention during the past year so far as alcohol is concerned, and in regard to the cymene as a source of toluol. The Imperial Munitions Board is quite willing to buy alcohol provided it be relieved from responsibility of the contract after the termination of the War. That is to say, that if the war should continue for two years or more, then the alcohol producers would be able to amortize their plant, but should the war fortunately terminate before then, the Munitions Board asks that the Government of Canada should assume the responsibility as a commercial proposition of absorbing the balance of the contract and using it for their methylated spirit operations, or otherwise dispose of it. With respect to the question of industrial alcohol, this matter has been before us for a great many years. Some years ago, the Society of Chemical Industry of Canada, went into this question and published a pamphlet which deals with the matter exhaustively in this connection. Dr. E. B. Shuttleworth, Toronto, devoted considerable time and consideration to the matter of industrial alcohol. Mr. Thos. Tyrer, late treasurer of the Society of Chemical Industry, labored hard for years to get industrial duty-free alcohol in England, and he was finally successful, though the amount of red tape associated with it was sufficient to cool his enthusiasm. Still, even in this modified form, it was of great assistance to England in the development of many of her industries. It is interesting to note that Canada is amongst the first of the nations to recognize the value of industrial duty-free alcohol, and when it was inaugurated, a large measure of development resulted but human nature unfortunately was more powerful than the stringency of the Department of Inland Revenue Regulations, which can be easily imagined, and the infraction of the law was such that the privilege was withdrawn and it has not been given again. We have arrived at a point, however, when it is necessary for the scientific men particularly, and those who are interested in the welfare of the industry of Canada to-day to see that the most strenuous representations are made to our Government that duty-free industrial alcohol is a necessity. It is almost unnecessary in a Committee of this kind to refer to the many directions in which such alcohol should be used. It is already to a large extent free in the manufacture of vinegar. It is largely free in the manufacture of perfumery, and it is entirely free in the manufacture, in this particular, of propellants and other explosives. Now, if we look at the group of industries which we have in Canada that depend upon our use of alcohol, we shall find that there are many, and at the same time that group might indefinitely be extended. We have manufacturers of pharmaceutical chemical products who use alcohol to a very large extent, much larger than ever imagined by those who are not familiar with this subject. Then we have manufacturers of fine chemicals. This line is limited but it could be expanded to great advantage as we now pay for imported fine chemicals in some cases less than the cost of the alcohol if made in Canada.

The question of free alcohol for hospital institutions is one that may be taken up with profit in Canada, because there is no free alcohol for hospitals and kindred institutions. Now in the United States alcohol for hospitals is quite free, but in Canada

it is not, and the result is that it is a source of considerable expense when a patient has to be bathed in alcohol, and in this country one of the greatest boons a patient can enjoy is being sponged with alcohol. In our own business we have frequently discussed the question of the extraction of fine alkaloids. We can do it in our laboratories and do it on a large scale, but we are stopped by the fact that if we do any experiments we shall have to use duty-paid alcohol, and then our investigation ceases. We can go no further for the want of duty-free alcohol. We have to stop right there. The time has arrived when we are in a unique position to ask the Government to set this free. The simple reason is that we have arrived at this particular point in our history that we have practically all our distilleries closed down, and the revenue from alcohol has come to a vanishing point. He was very glad to say that after many negotiations backwards and forwards, they have been able to get Canadian distilleries to see that they can manufacture alcohol and compete with the Americans, with some slight consideration for the Imperial Munitions Board, but suppose our works should close down at any day, then these distilleries would have to cease. We have arrived at a point, then, we may say, that practically our distilleries are working on special war work and therefore might be stopped at any time, but if we can induce the Government to grant the privilege that we are asking for, then we may ensure for the future the employment of these distilleries in making alcohol for industrial purposes and thereby retaining to the proprietors a considerable amount of their capital value and at the same time contributing to the industrial development of the country. With respect to pharmacy, if we are to get any advantage from the present condition with respect to alcohol, it should lead to a very considerable reduction in the price of medicinal preparations and one is pleased to hear of reduction these days in the cost of anything, to the consumer.

The question of research appeals to us very strongly. A great deal of our research is our own experience, but that research is checked by the knowledge that if research is carried out alcohol will be wasted.

One of the problems that we have to face in Canada at the present time is the fact that in our demands for toluol, we are necessarily calling for increased toluol, hence we are producing very large quantities of benzol which has very little market value.

With respect to aniline dyes, I am not too sanguine, but look forward to the development of the aniline dye industry in this country, if opportunities are given. If we are given the chance of applying industrial alcohol, I can see very considerable advance in many directions. In the past, there has been several factors against it. One has been the protection of revenue, and then the almost universal prohibition throughout the country. We have had the fact established that we have results of having absolutely duty-free alcohol in plants which would be under control of working men, where 2,000 men were employed and the cases of wrong use of the alcohol are comparatively rare.

With respect to the question of the employment of duty-free alcohol, and for the reasons first mentioned, it would be wise if this department were to pass a resolution, and he therefore moved that:

"Whereas, the fact that alcohol for industrial purposes, free of duty, has contributed much to the prosperity of several countries, and as Canada has a number of distilleries now lying idle, and as new processes are now available for making alcohol from non-edible materials, and as the Dominion has an unusual opportunity of extending its industries in many directions, that a new source of motor fuel is desirable, and as alcohol is now an unimportant source of revenue; be it resolved that the Government be petitioned to permit the use of duty-free alcohol, subject to restrictions which would protect revenue and public safety."

Dr. Ruttan observed that this was one of the biggest questions before the chemists of Canada to-day. The difficulties are very great, and he hoped that Dr. McGill would point out the obstacles that lie in the way of carrying out this plan, so that we may have both sides of the question. No doubt the world is going to recognize that industrial alcohol should no longer be produced from food stuff. Our other sources of alcohol, viz., sulphite liquor waste and our waste wood can produce all the ethyl alcohol used in Canada. Two pulp mills alone in Canada promise to produce 680,000 gallons of alcohol per year, and the industrial alcohol used before the war was less than one million. ethyl alcohol from sulphite liquor contains small percentage from about .6 to about 3, of methyl alcohol. Then, again from the wood waste, we can obtain a spirit which is purer than that which is obtained from grain.

Aldehydes are the only impurities in alcohol from wood, and, as we know, much more easily got rid of than the impurities in grain spirit.

Dr. McGill said the excise tax on ethyl alcohol has from time immemorial constituted a very important part of the federal revenue. From this point of view the recent legislation by our province, and possibly federal legislation will undoubtedly in the future greatly reduce the importance of ethyl alcohol as a source of revenue. This consideration will lead the department of the government which has control of the sale of ethyl alcohol to consider very favorably and with all due respect to the importance of the results any propositions that you may make. Ethyl alcohol in a practically pure state is already available for the manufacture of vinegar, perfumery and for use in war munitions. It is possible for us to check quite closely the employment of alcohol in their manufactures. The relation between alcohol and acetic acid is so well defined, as to make it possible for us to check the total vinegar produced against the amount of alcohol ex-warehoused for its production. In certain classes of perfumery ethyl alcohol is now permitted practically pure. This is because the cost of the essential oils required in the manufacture of perfumery is so great as to make it impossible that the products should be sold at a price to make it available as a beverage. The Department of Inland Revenue has had up many times before the question of granting pure ethyl alcohol for hospital use. He was justified in saying that the Department is exceedingly anxious to meet the reasonable requests of the physicians in charge of hospitals and to allow alcohol for this purpose. The great difficulty is to check the destination of the alcohol. If conditions should be fixed by which all institutions should be granted alcohol under conditions that would guarantee its uses for bona fide medical purposes there would be no difficulty in the matter. The great difficulty is to distinguish between responsible institutions and such as are merely nominally responsible, and which would set up claims from untenable points of view. He was not giving away any secret information in saying that we have facts in our possession to show that certain Governments have been rather too willing to concede the use of alcohol to institutions where it was not put to its proper use, in consequence of which revenue has very seriously suffered. For research purposes in universities and colleges, the Department of Inland Revenue is quite willing, he believed, to grant the use of pure alcohol so far as we can get a proper guarantee of legitimate use. For war purposes, ethyl alcohol is available, but of course we quite well understand that such action is part of war policy, and is not to be interpreted as a precedent for ordinary times. If alcohol could retain its value to the manufacturer while still rendered non-usable as a beverage, there would be no difficulty in manufacturers securing alcohol for their purposes, and ethyl alcohol containing 10% of methyl alcohol is available for all purposes for which such an alcohol can be used.

Regarding alcohol used for chemicals, where the alcohol is destroyed as such, and does not appear in the final product, it

is only necessary to find a trustworthy means of checking the amount of tke product against the amount of alcohol employed in its production. The manufacture of vinegar is a case in point. Fulminate manufacture is another instance. The use of alcohol as a solvent is provided for. Arrangements have been made whereby alcohol is recovered by the use of a registered still and in the long run a comparatively small amount only is lost in most operations of the kind. Thus the employment of duty-paid spirit need not inflict any great hardship, and may be regarded as an item on capital account only, not on the continuous cost of production. When application is made by any manufacturer for the use of ethyl alcohol, pure ethyl alcohol, in manufacturing, we put it up to the requisitioner to suggest a material which might be added to the alcohol as a denaturant, without interfering with the use to which the alcohol is to be put. They ask us to name a denaturant which will be acceptable to us. A result of proper and reasonable experimentation on the part of the manufacturer would in many cases enable him to suggest a denaturant which might guarantee to the department no loss in revenue. However, the question of revenue from alcohol is very likely in the future to be less important than it is at present, and the department is entirely in sympathy with the desires of this Committee to allow the use of alcohol in every legitimate manufacture so far as is consistent with the responsibility which lies upon it as a revenue collecting agency. We recognize the force of the contention re increasing the facilities for alcohol manufacture in Canada as manufacturing industries increase in importance.

Dr. Goodwin mentioned an incident bearing on what had been said in reference to denaturing of alcohol, with 10% methyl alcohol, also in connection with the use of alcohol for bathing patients. A patient in his own family had to be bathed with alcohol last winter, and developed an irritation of the eyes. He went into the subject and found that the alcohol being used was wood alcohol which, of course, was promptly stopped. It seems that the fact that wood alcohol was being used under the care of a nurse and doctor in his family shows we ought to go into the whole subject from that standpoint at any rate.

Dr. McGill said some people's optic nerves seem to be particularly susceptible to ethyl alcohol; others are not. It may be interesting to know that only last winter he prepared denatured alcohol in various ways and submitted it to Dr. Blackader for use in Montreal hospitals. Among other things, we denatured with 1% to 2% benzol. Certain physicians stated that they found no bad results from it, but the characteristic odor of benzol of course gave a prejudice against its use. He heard of no actual harm resulting from the use of ethyl alcohol containing 2% benzol and if such alcohol could be used, denatured as suggested, it would do away with any difficulties in the way of granting free alcohol for hospital use.

Dr. Goodwin asked if he was right in stating that Research institutions can at present obtain pure alcohol without duty.

Dr. McGill said he understood that on giving proper security, this is possible.

Dr. Parker said he wrote to the Department of Trade and Commerce, and was told that nothing could be done to lighten the price. For his own work in Winnipeg he could not obtain duty-free absolute alcohol.

Dr. Ruttan said McGill University had no difficulty in obtaining alcohol 95% ethyl alcohol for university use, but they had to state for what it is used, and it is kept under control of one of the staff.

Dr. Bates said the idea of paying $8.00 a gallon was absolutely ridiculous when it was required for scientific and industrial use. A strong committee might well be formed to compare the various processes of manufacture, to find out the present uses of alcohol in this country; to advise regarding new uses and in general to investigate the whole subject for the benefit of Canadian chemists and chemical industries.

Mr. Wardleworth said it might be a subject for conference with the Government, in order that the authorities might see the wisdom of our attitude and the logical position that we are taking. Dr. McGill has referred to the revenue end of it. There is practically no revenue now compared with what it was a few years ago. This is to all intents and purposes a dry country, and in 1919 we shall be dry from the Atlantic to the Pacific. Therefore, it seems to me that the question of revenue has ceased to be a bugbear.

After further discussion Mr. Wardleworth's motion was seconded by Dean Goodwin and adopted. Dr. Ruttan said the resolution would come before the Advisory Council and would be seriously considered.

Recent Incorporations

Toronto.—The Golden Wonder Mining Company, Limited. Robert Martin. Capital, $100,000. To carry on the business of a mining, milling, reduction and development company and to deal in metals, minerals and chemicals.

Montreal.—Canadian Refractories, Limited. Ernest Lafontaine, solicitor. Capital, $20,000. To manufacture refractory bricks, tiles, china and ceramic ware and to deal in artificial stones.

Kingston.—N. C. Polson & Company, Limited. Neil Currie Polson, sr., manufacturer. Capital, $300,000. To take over the wholesale drug and chemical business of N. C. Polson & Company, and to manufacture and deal in medicines, chemicals, scientific apparatus and surgical instruments.

Toronto.—R. H. Comey Company, Limited. Hamilton James Stuart, solicitor. Capital, $100,000. To carry on business as dyers, bleachers, and to manufacture and deal in chemicals and vegetable fabrics of every description.

Montreal.—John Cowan Chemical Company, Limited. Edward Ernest Wells, chemist, Westmount. Capital, $200,000. To manufacture and deal in chemicals, dyestuffs, pigments, acids, oils, rubber, coal-tar and products thereof, and to locate and operate mineral and coal lands.

Cornwall.—Medical Hall Company, Limited. John Stuart Duggan, Toronto, solicitor. Capital, $10,000. To carry on business as chemists, druggists and chemical manufacturers.

Sudbury.—Sudbury Diamond Drilling Company, Limited. J. A. and Thos. M. Mulligan, solicitors. Capital, $100,000. To acquire mines and mineral lands and deposits, and to assay, and treat ores, metals and minerals.

Ottawa.—The H. J. Daly Drug Company, Limited. Wm. S. Morlock, Toronto, solicitor. Capital, $40,000. To carry on business as chemists, druggists and chemical manufacturers.

Hamilton.—Glendale Spinning Mills, Limited. Sanford D. Biggar, K.C., solicitor. Capital, $500,000. To manufacture and deal in cotton, wool, worsted and other fibrous substances and to carry on business as flax and hemp spinners, linen manufacturers, bleachers and dyers.

Toronto.—The National Molybdenite Company, Limited. Henry Jasper Martin, solicitor. Capital, $1,500,000. To acquire mines and mineral lands and deposits, and to smelt and otherwise treat ores, metals and minerals, and to carry on business as iron masters, steel makers and engineers.

Toronto.—Harmak Mining Company, Limited. Arthur L. Reid, solicitor. Capital, $300,000. To acquire mines and mineral lands and deposits and to treat ores, metals and minerals.

An Order-in-Council was passed on July 17, 1918, changing the corporate name of Canadian Hoskins, Limited, Walkerville, to that of Hiram Walker & Sons Metal Products, Limited; also increasing the capital stock of the company from $40,000 to $250,000, and extending the power of the company to enable them to carry on business as foundrymen, wire manufacturers and machinists. The number of directors has been increased from five to seven.

Exposition of Chemical Industries

Thousands of chemists from all parts of the continent are planning to go to New York to attend the various conventions to be held by chemical and technical organizations in connection with the National Exposition of Chemical Industries in the Grand Central Palace during the week of September 23rd. The Exposition promises to be the largest and most complete yet held. Three floors of the palace were used last year, but this year four floors have been taken.

While the Exposition will bring manufacturers of machinery, equipment, products and supplies together with men who are using them, its chief effect will be to show the people that the chemists of America have made advances greater than ever before. Much of the success of winning the present war depends upon chemicals and the chemical engineer. The convention will bring to light some of the marvellous results of recent research, and many engineers and experts who hold important positions in the advance of the chemical industry will be speakers at the various industrial conferences. The proceedings will develop matters of timely interest to the public as well as to the assembled delegates.

The Exposition is a war-time necessity and regarding it as such each exhibitor is planning his exhibit so that it will be of the greatest benefit to the country through the men who visit it, all of whom are bent upon a serious purpose—that of producing war materials in large quantities, and constantly increasing this production till the war has been won.

Papers covering practically every phase of chemistry and a discussion of steps that will need to be taken after the war, will be presented by leading experts in each branch. Pressing chemical problems concerning many of the chief articles of domestic and foreign commerce will be taken up during the convention, and it is expected these discussions will have an important bearing on the future manufacture of materials that have been scarce and high-priced ever since the curtailment of American commerce with Germany and other European countries. In order to fill the demands for chemicals hundreds of factories have sprung up in various parts of the country, and while doing a large business, it is pointed out by experts that there is a lack of preparation to meet new conditions which are bound to follow at the close of the war.

Mr. Charles F. Roth and Mr. F. W. Payne are joint managers of the Exposition and their headquarters are in the Grand Central Palace, New York.

The attendance from Canada will no doubt be greater than ever. It is expected that the Department of Mines and the Department of the Interior of Canada will be represented again, and that one or more department of the Quebec Government will have a space. The Bureau of Mines of Ontario will have a booth at which specimens of minerals and metals will be shown. The Shawinigan Water & Power Company have arranged for a comprehensive representation of the electro-chemical industries of Shawinigan Falls; and the THE CANADIAN CHEMICAL JOURNAL has engaged booth No. 475, where its readers will be welcomed, and where visitors may make use of its Bureau of Information. If other Canadian exhibits come in which are expected the representation from the Dominion will be the most important in the history of the Exposition.

Industrial News

The Canadian Aeroplanes, Limited, are building a brick addition to their factory in Toronto to cost $40,000.

The British Acetones, Toronto, are erecting a new addition to their still department to cost $15,000.

It is the intention of the Dominion Government to establish an ore testing mill in British Columbia, but as the appropriation required to carry out the project was not made at the last session of the Federal Parliament, the erection of the plant will be delayed for another year.

Brandram-Henderson, Limited, announce that they have purchased the plant of the Alberta Linseed Oil Mills at Medicine Hat. The capacity of the plant is now being increased 20%, which will give the company a surplus over their own requirements.

The Hall Match Company, of Vancouver, have started the manufacture of matches. They have been experiencing some difficulty in securing a sufficient supply of chemicals, but this is being overcome, and the company expect soon to be in a position to take care of the match business for the province of British Columbia.

The Premier-Langmuir Barite Mining Company have started operating a barite mine some distance from Connaught station on the T. & N.O. Railway. The mill has a capacity for treating 30 tons of barite per day, by the dry process. The price obtained is reported to be $38 a ton at the railway station. The deposit is said to be large and easily mined, there being a stretch of 1,400 feet on the surface in one vein 2 to 8 feet thick.

The Dominion Asbestos Spinning Company has started a plant at East Broughton, Que., for the manufacture of asbestos yarn, carded asbestos and sheet packings. Asbestos cloth, brake linings and packings will be manufactured later on when the necessary machinery can be secured. Importations of foreign asbestos having been cut off there is a large demand for Canadian asbestos and several properties that had been idle for years are now being worked in Quebec.

A federal charter has been granted to J. H. Acer and Company, Limited, with headquarters at Montreal; capital stock, $100,000. The company is to manufcture and deal in pulp and paper, card board and wood products, and to act as manufacturers' agents in such commodities. Mr. J. H. Acer, the head of the new organization was formerly sales manager of the Laurentide Company, and president of the Canadian Pulp and Paper Association.

The North American Arms Company, which has taken out a Canadian charter with a capital of $2,000,000 has leased the Ross rifle factory at Quebec from the Dominion Government, and will make army revolvers for the United States Government. One of the directors is Mr. T. A. Russell, of Toronto.

Imports into the United States of chromite from Rhodesia and New Caledonia having been prohibited on account of shortage of ocean tonnage, American users have had to depend more on the domestic product and ores from Canada. In consequence there will be a largely increased production of chromite in Quebec, as the requirements of the United States for 1918 will be about 160,000 tons of ores, and last year the United States and Canada together produced less than 60,000 tons.

Two important orders-in-council have been passed by the Dominion Government governing the import and export of commodities included in a list recently proclaimed by the United States Government. The restrictions in the import and export of these goods are imposed to conserve ocean tonnage, and the purpose is to make the regulations uniform. As these commodities include hundreds of items of chemicals and chemical raw materials that require an import license, Canadians affected should apply to customs officers or the War Trade Board, Ottawa, for a list of the articles for which a license is necessary.

The Canada Copper Company is at present constructing a railway, about fourteen miles long from the town of Princeton, B.C., to its mineral claims on Copper Mountain, connecting with the Kettle Valley Railway. An oil flotation plant, having a daily capacity of 3,000 tons of ore, is being built near Princeton on the line of the new railroad, on the building of which two hundred men are at work. A year ago it was announced that the presence of at least five million tons of ore in this Copper Mountain had been proved, and there has since been a considerable increase.

System of Chemical Shorthand

In reply to enquiries regarding the system of chemical shorthand, outlined in the May number, we may say that the author is Mr. Ingo Hackh, now a resident of Berkeley, Cal. Mr. Hackh is twenty-eight years of age and began the study of chemistry at the age of fourteen. He made a study of the periodic system and papers by him on that subject have appeared in the American Journal of Science and in the Journal of the American Chemical Society. From 1913 to 1915 he was chemist at the Von Ruck Research Laboratory for Tuberculosis, in Asheville, N.C. He came to California in 1916 and was appointed lecturer and assistant in laboratory work at the University of California. In February of this year he was appointed associate professor of chemistry at the College of Physicians and Surgeons in San Francisco.

While the symbols of inorganic chemistry represent in themselves an efficient system of shorthand, a number of readers are of the opinion that for organic chemistry Mr. Hackh's system should prove practical. To be of wide service the student as well as the teacher should become a writer of it, just as newspaper reporters become as familiar with Pitman's and other systems of shorthand as with the letters of the alphabet. The author has used it successfully in his own classes and some of our correspondents see in it a valuable time saver in abstracting work.

Ingo Hackh

It is the belief of one of our readers that it will not only prove "a saving of time in writing and manipulating structural formulae for organic compounds," but that it will "supply more concise mental images in memorizing the structures and compounds." So far as is known this is the first system of chemical shorthand placed before the chemical world, and the young author is to be congratulated upon its development.

Hydraulic Developments and Transportation at Niagara Falls

The Niagara Falls Evening Review publishes an instructive address recently delivered by Principal A. N. Myer, of the Stamford High School, on the possibilities of a ship canal to be operated in connection with the new Hydro Electric power canal.

Principal Myer recalls the fact that the great industrial centres around Pittsburgh owed their favorable beginning to the junction in that locality of the Ohio and Monongahela rivers which gave the advantage of water transportation for the raw materials of iron, coal, etc., in the early days. The municipalities around Niagara Falls have in the hydraulic power of the Niagara a natural asset comparable to the coal of Pennsylvania; and it is the contention of Principal Myer that this and other assets of the Niagara peninsula could be co-related to the advantage of the whole country. An engineer of standing has assured him that it is quite feasable, with a trifling cost in land damage, to transfer the proposed lock of the new Welland Canal from Port Robinson to Montrose (near Chippawa) and, by broadening and deepening the new Hydro Electric Commission's power canal for a distance of less than two miles, this would give the towns about Niagara Falls the advantages of an ocean port at the foot of these locks. On the authority, presumably, of the engineer referred to, Principal Myer estimates the extra cost at only $50,000.

Principal Myer states that because of the present shortage of hydraulic power a number of industries have been lost to Niagara Falls, instancing the Canadian Aloxite Company, which has located at Shawinigan Falls, the American Cyanamid Company, which is locating its new extensions in the United States instead of the Canadian side of the Niagara where its first works were built, and the Norton Company which has had to make shift by hiring power from three other companies.

Canada, as a whole, would be benefitted by combining the plan for increased power with cheap water transportation, since economical manufacturing of electro-chemical products depends upon a continuous supply of current at cheapest possible rates together with the best possible transportation facilities. He applies the argument to the nitrogen problem as follows:

"Canada's whole future depends upon the successful operation of these industries, especially the extraction of nitrogen from the air by the cyanamid process. This nitrogen is one of the main requirements for artificial fertilizer and for explosives in war. Germany would long ago have been a beaten nation had not her chemists discovered the secret of extracting nitrogen from the air. Before that discovery was made the world got its nitrogen from the mines of Chili, and it was to cut off Britain from her nitrogen supply that a German squadron was skulking around the coast of South America shortly after the outbreak of the war. With the establishment of a Canadian cyanamid plant and allied industries on the banks of this Hydro ship canal, Canada will become the world's great electro chemical manufacturing centre, with the hub at Niagara Falls; the consequent manufacture and distribution of fertilizers will make Canada the world's greatest agricultural country, her widespread acres rivalling in fertility Germany's restricted fields; and last, but not least, no more in time of war will Britain be dependent upon the whims of a foreign country for the basic ingredient required in the manufacture of her explosives."

In conclusion Principal Myer appeals for an investigation of his proposal by the Dominion Government and the Ontario Hydro-Electric Commission.

Aftermath of the Convention

A pleasing ceremony took place on the 9th July at the Explosives Department of the Imperial Munitions Board, when a deputation representing the members of the Society of Chemical Industry, resident in Ottawa, invaded the office of the retiring chairman, Mr. T. H. Wardleworth, and presented him with a framed photograph of those present at the convention, in recognition of the services he had rendered the Society and in appreciation of his faithful attention to the duties of his office.

Amongst those present were Dr. Frank T. Shutt, Mr. L. E. Westman, Mr. A. L. Robertson, Mr. Joseph Race, F.I.C., Mr. M. F. Connor, Mr. O. D. J. Thomas, the honorary secretary, Mr. Alfred Burton, and Lieuts. G. N. Ponton, D. S. Cole and G. A. Holland.

Personal

Mr. A. H. Brown has returned to the Hudson Bay and Dome Lake Mines as manager, succeeding Mr. Douglas Mutch, who is now manager of the Ankerite property of the Coniagas Mines.

Mr. F. J. Brule, assistant general manager of the British America Nickel Corporation, has transferred his office from Sudbury to Deschenes, Que., where the company's refinery is being erected.

The United States Government has secured the services of Dr. James C. Miller, director of technical education of the Province of Alberta, and principal of the Institute of Technology of Calgary, to take charge of a department of vocational education for returned American soldiers.

The Trade Marks and Patents, hitherto a branch of the Department of Agriculture and now transferred to the Department of Trade and Commerce, will be in charge of Mr. G. F. O'Halloran, who will be known as the Solicitor of Patents and Copyrights. Mr. O'Halloran has been for a number of years Deputy Minister of Agriculture.

Perhaps for the first time in history a scientific and industrial convention has been presided over by a lady. This took place at Revelstoke, B.C., when Mrs. Ralph Smith, M.L.A., took the chair at the International Mining Convention, July 8th to 11th, held in that mining centre. Of the event the Vancouver Province says: "The selection of Mrs. Smith for the position as chairwoman at the convention is not only a compliment to the lady herself but is intended to respect also the fact that the late Hon. Ralph Smith, former minister of finance for British Columbia, who died so suddenly not long ago, was at the outset of his life a working miner."

The success achieved by Mr. T. C. Newman, fourth year student in the University of Toronto, is an example of what is attainable to young Canadians of ability and determination in the field of industrial chemistry. Mr. Newman was offered work at the British Chemical Company, Trenton, Ont., and with the consent of that company was transferred to the works of the British Acetones, Limited, at Toronto, where acetone was being made at the distill ry of Gooderham & Worts. His work here was so correct and satisfactory that he was offered a wider field and by arrangement between the explosives departments of the two governments he was placed in charge of the acetone works of the Commercial Solvents Corporation at Terre Haute, Ind. At the present time Mr. Newman is in charge of six distilleries controlled by this corporation with four graduates under him.

Book Reviews

The first edition of "The Chemists' Pocket Manual," compiled by Richard K. Meade, M.S., formerly editor of the Chemical Engineer and author of a text book on "Chemical Laboratories," was published in 1900. The third edition has now been issued by the Chemical Publishing Company, Easton, Pa. This edition contains 530 pages, 4×6, printed on strong paper and bound in flexible leather, at $3.50 per copy. It contains many tables and much data on problems of chemical engineering that were not treated in the first and second editions. It is designed, therefore, to be a text-book for the chemical engineer as well as the analyst, and the work gives evidence of great care and accuracy in the data and facts presented in each department. Much attention appears to have been given to metals and alloys, while the treatment of chemicals in general is quite comprehensive. A number of the old tables—such, for instance, as those on the chemical composition of steel—have been revised according to the new standards, and many new methods for the determination of minerals and metals have been added. The work makes an indispensable manual for the chemist, metallurgist and the chemical engineer and assayer.

Under the general title of "Chemical Monographs," Messrs. Gurney & Jackson, 33 Paternoster Row, London, E.C., have issued a series of what may be termed popular handbooks on phases of industrial chemistry, which have an appeal to the general public as well as to the industrial chemist. Among the several that have been issued one of the most interesting is that on "The Fixation of Atmospheric Nitrogen" by Joseph Knox, D.Sc., lecturer on Inorganic Chemistry in the University of Aberdeen. The author does not waste space in discussing the merits of the many hundreds of processes that have been subjects of patents in nitrogen compounds, but confines himself to those that have been put into actual operation or show promise of coming into practice in the near future. Section 1 of this useful little handbook treats of the fixation of atmospheric nitrogen in the form of nitric and nitrous acids or their salts. Section 2 deals with the production of ammonia and its compounds from the nitrogen of the air, and section 3 treats of the conversion of those forms of atmospheric nitrogen that yield ammonia readily. The book contains 112 pages, and appended to it is a bibliography containing quotations from 153 other works and magazines, so that it furnishes the key to much up-to-date literature on a subject which is of great importance to Canadian chemists, in view of the certainty that Canada will at no distant date be a great manufacturer of nitrogen in its various forms. This book is issued at the popular price of two shillings.

Reference was made in our June number to Dr. John Waddell, of Queen's University, Kingston, as the author of a standard treatise on "Quantitative Analysis." We have now received from the publishers, Messrs. J. & A. Churchill, of London, England, through their American agents, Messrs. P. Blakiston's Son & Company, Philadelphia, Pa., copy of the work. In the 162 pages of this work, designed for colleges and universities, Dr. Waddell treats of methods of analyses in general practice, and of the more recent tendencies to changes and improvements. The special topics taken up are, among others, barium chloride, magnesium sulphate, calcium carbonate, cement, limestone and clay, coal, copper, iron, bronze, steel, lead, nickel, cobalt, zinc, and ores of the same. Several appendices are added, dealing with the use of balances, weights and apparatus. The author endeavors to help the student by giving the kind of information that will save his time—and the saving of time is certainly to be appreciated by the student of to-day.

Laboratory Tests of Coal-Coke-By-Products

Some trade catalogues and booklets may almost be classed as text books, and of this character is a pamphlet entitled "Standard Laboratory Tests of Coal-Coke-By-Products," issued by the Scientific Materials Company, Pittsburgh, Pa. The pamphlet is the result of the company's effort to put on the market apparatus that will adequately meet the requirements of chemists in this field. The subjects illustrated treat of acid-wash tests for benzol, apparatus for boiling-point determinations, apparatus for standardizing thermometers, combustion apparatus for determining the relative yields of coke and by-products by the progressive dry distillation processes as carried out by the United States Steel Corporation, fuel calorimeters, burners for determining the volatile matter in coal, muffle furnaces, apparatus for the analysis of nitrogen in coal and for determination of ammonia, apparatus for examination of gas, distilling apparatus for determining the water in tar and apparatus for tar examination—with many other items and apparatus, quoting prices for the same. This pamphlet, which appears to have made a strong appeal to chemists interested in this field, will be sent free on application to the company above named.

The National Abrasives Company are moving their works from Hamilton to Renfrew, Ont. The works will be operated by electric power from Calabogie Falls.

Chemical and Metal Markets

The Quotations below represent average prices for the quantities indicated. Larger quantities may be obtained at lower figures.

TORONTO, July 26, 1918.

Both the chemical and metal markets have been quiet during the month. Apart from the effect of the holiday season, the order-in-council, enumerating a long list of chemicals and metals, the import and export of which require a license to put the business of Canada and the United States on a common footing acts as a blanket on the whole field of trade.

The iron and steel mills of Canada are producing to their limit, but as the Government stands at the back of the system of allotting the output for the primary needs of the shipbuilding and munition industries the progress of the industries of civil life is hampered. The dividends paid in the metal industries—a noteworthy feature being a total of $3,000,000 in dividends in the Cobalt and Porcupine regions of Ontario—shows that operations are not without profits in the production of metals. A notice from the United States War Industries Board that the requirements of steel products for the next six months will be 20,000,000 tons, or 3,500,000 more than the apparent output, is significant.

The shortage of manganese, chrome and asbestos throughout American has given an impetus to the production of these minerals.

The international sulphur situation is such that an American expert believes it will be necessary within the next month for the Government to commandeer the sulphur supplies. The Sicilian supply is said to be barely more than enough for Italy while the efforts of Germany to obtain suphuric acid by pyrites from Sweden and Norway have been countered by sinkings of cargoes by allied submarines; and that as German submarines are by the same means seeking to sink cargoes of pyrites going to Great Britain, this all tends to accentuate the world's shortage.

In the local market alum is scarce. Acetone, owing to war requirements, may be counted off the market.

Our Montreal correspondent writes: The supply of salammoniac is practically exhausted. In pre-war days it sold at 12c. a lb.; now it hs gone up to $1.25, but cannot be had even at that figure. To metal firms, and those eengaged in the manufacture of galvanized iron, this is a serious shortage. In addition, manufacturers are finding it difficult to get adequate supplies of tin, spelter and other commodities of a similar nature. Generally speaking, the range of supplies in industrial chemical lines, is narrowing. In heavy lines there is every indication of prices going higher, as all costs of production are on the increase, while embargoes, licenses and increased freight rates and other difficulties all add to the cost of doing business. Manufacturers state that they are loath to book orders far ahead.

Our New York correspondent reports that President Wilson has approved the recommendation of the War Industries Board to take over the sulphur industry, although the step is opposed by the trade. It is said that present U.S. consumption is 125,000 tons a month, but that this will soon be increased to 150,000 tons. At present mines are overworked. It is proposed to turn to the waste from smelters. This is interesting to Canadians seeing that in the Sudbury district the sulphur going to waste and poisoning the vegetation would produce millions of gallons of sulphuric acid a year.

The U.S. War Industries Board has also taken over the production of chlorine for war gas purposes and has placed Mr. H. G. Carrell, of the Solvay Process Company in charge. This will have a more or less serious effect on the bleaching industries of the pulp, paper and textile trades.

The price of sulphuric acid has been "fixed," the following being the maximum prices to take effect now as agreed on by the War Industries Board of the United States. Sulphuric acid, 60 degs. Baume, $18 per ton of 2,000 pounds; sulphuric acid, 66 degs. Baume, $28 per ton of 2,000 pounds; sulphuric acid, 20% oleum, $32 per ton of 2,000 pounds; f.o.b. at manufacturers' works in sellers' tank cars. In carboys in carload lots, ½c. per pound extra. In carboys in less than car loads, ¾c. per pound extra. In drums, any quantity, ¼c. pound extra. Nitric acid, 42 degs. Baume, 8½c. per pound f.o.b. manufacturers' works in carboys. A schedule of maximum prices on mixed acids is being prepared. These prices are agreed upon for the public, as well as the Government. It is understood that any deliveries made after September 30th will be subject to revision in price by the Government.

Acetanilid, C.P.	Lb.	1.10—1.20
Acetic acid, commercial, crude, 28%, in bbls.	Lb.	10⅛—10⅜
" " 80 per cent. pure	Lb.	.35—.37
Acetone		(Nominal)
Alcohol. grain, bbl	Gal.	8.50
Alcohol, methylated, .bbl	Gal.	1.65
Alcohol, wood, 95 per cent., refined bbl	Gal.	1.60
Alum, ammonia lump	100 Lbs.	$6.00—6.50
Aluminum Sulphate, high grade, bags	100 Lbs.	3.50—4.00
Ammonia, Aqua .880	Lb.	.16—.18
Ammonium Carbonate	Lb.	.16—20
Benzoic Acid	Lb.	5.50—6.00
Bleaching Powder, 35% drums	100 Lbs.	3.50
Borax, crystals	Lb.	.10—.10¼
" powdered	Lb.	.10—.10½
Boric Acid, powdered	Lb.	.22
Calcium Chloride, fused, in drums	Lb.	.2½
Carbolic Acid, white crystals	Lb.	.85—.90
Carbon Bisulphide	Lb.	.25—.30
Caustic Soda, ground, Bbl	Lb.	.10—.11½
China Clay, imported	per ton	$25—$30
Chloroform, com	Lb.	1.00—1.40
Citric Acid, domestic, crystals	Lb	1.15—1.40
Cobalt Oxide, black	Lb.	1.50—1.75
Copper Sulphate (Blue Vitriol)	Lb.	.13—.19
Fuller's Earth, powdered	100 Lbs.	6.00
Glycerine, 56 lb. tin	Lb.	.80
Hydrochloric Acid, carboys, 18°	Lb.	.03¼—.03½
Lead Acetate, white crystals	Lb.	.25
Lead Nitrate	Lb.	.18—.20
Magnesium Carbonate, B.P., bbl	Lb.	.22—.25
Nitric Acid, 36° carboys	100 Lbs.	.11
Oxalic Acid	Lb.	.55—.60
Potassium Bromide	Lb.	2.10—2.35
Potassium Carbonate 90 to 95%	Lb.	1.75—2 00
Potassium Chlorate, crystals, Kegs	Lb.	.55—.60
Potassium Nitrate......, Kegs		(Nominal)
Potassium Permanganate, bulk	Lb.	4.25—4 50
Salicylic Acid	Lb.	1.25—1.50
Silver Nitrate	Oz.	1.00—1.10
Soda Ash, bags	Lb.	.04—.05
Sodium Acetate	Lb.	.20—.22
Sodium Bicarbonate, 100% pure	100 Lbs.	4.00—4.50
Sodium Bichromate, bbls,	Lb.	.24—.25
Sodium Cyanide, bulk, 98-99 per cent, in cases	Lb.	.38—.40
Sodium Hyposulphite, kegs	100 Lbs.	3.60—4.00
Sodium Nitrate, refined	100 Lbs.	8.50—9.00
Sodium Silicate, according to density	100 Lbs.	5.00—6.00
Sulphur, ground	100 Lbs.	3.00—3.25
Sulphur, roll	100 Lbs.	4.75—5.00
Sulphuric Acid, 66°Be, carboys	100 Lbs.	3.25—3.75
Tannic Acid, commercial	Lb.	1.90
Tartaric Acid, crystals or powdered	Lb.	.95—1.00
Tin Chloride, crystals		(Nominal)
Zinc Sulphate, com	Lb.	.6½—7.00

Antimony is quoted at 20c. a lb., no other change in metal prices.

Industries of Dundas

The town of Dundas, Ont., has made great progress during the past three years and much new building has gone forward both in industrial works and in residences. Prominent among the industrial undertakings are the extensions made to the works of the John Bertram & Sons Company, who also control the newly erected works of the Pratt & Whitney Company of Canada. It is a pleasure to record such progress for no Captain of Industry bore a more honorable name as employer and citizen than the late John Bertram, and the high traditions of the founder have been maintained by the sons now in control. The machine tools made by the John Bertram & Sons Company comprise complete equipment for locomotive and car shops, structural iron works and general machine shops, and many of our largest chemical and metallurgical works have been equipped by them. The new extensions, started last January and now complete, include two shops, one 324 feet long and the other 284, of modern construction and capable of turning out material sufficient to fill five cars a day. One of the newly installed devices is a magnetic crane which lifts 2,500 pounds at a time and has a loading and unloading capacity equal to the work of eight men. That this crane is not idle may be evident from the fact that the turnings to be handled average 50 tons a day. The new works of the Pratt & Whitney Company are devoted to small tools and all kinds of special tools, for which the firm have long had a high reputation. The office buildings, now completed, for both companies, are not surpassed by any in Canada for equipment and modern conveniences. The drafting room is 48×35 feet and plans and records are kept in vaults with steel cabinets, while there are complete photographic and blue print rooms, provided with the best printing apparatus and electric dryers, etc. That the social welfare of the employees is not overlooked is evident from the provision of bowling greens, lawns and flower gardens that were being laid out on the occasion of the writer's recent visit.

CLASSIFIED INDEX OF ADVERTISEMENTS

Acetone and Acetates—
Standard Chemical Co.

Acids—
Dominion Tar and Chemical Co.
Merck & Co.
Standard Chemical Co.
Mallinckrodt Chemical Works
McArthur Irwin Limited
Nichols Chemical Co.
The Topley Co.
Caravel Company, Inc.
Levinstein Limited
U.S. Varnish Co.

Acid-proof Paints—(See Paints)

Acid-proof Pipes and Tubes—
Maurice A. Knight
United Lined Tube & Valve Co.
U. S. Stoneware Co.

Air Compressors—
Canadian Ingersoll Rand Co.

Alcohol, Wood—
Standard Chemical Co.

Alum—
A. M. Huestis.
Nichols Chemical Co., Ltd.

Architects—
Samuel M. Green Co.

Arsenic—
Coniagas Reduction Co.
Deloro Smelting & Refining Co.

Autoclaves—
Valley Iron Works.
Lymans, Limited.
Scientific Materials Co.
Ernest Scott & Co.
The Topley Co.
Detroit Heating & Lighting Co.

Babbitt Metal—
Canadian Fairbanks-Morse Co.

Barrels—
W. D. Beath & Sons, Limited
Charles Mueller Co., Limited
Smart-Turner Machine Co.

Bismuth, Metal and Salts—
Merck & Co.

Bleaching Powder—
Canadian Salt Co.
T. E. O'Reilly.
Nichols Chemical Co., Ltd.
Wilson Paterson Co.
A. Mendleson's Sons.

Bunsen Burners—
Detroit Heating & Lighting Co.

C rbide—
Canada Carbide Co.

Caustic Soda—
Canadian Salt Co.
Mendleson, A's Sons.
Wilson Paterson Co.
Merck & Co.
Nichols Chemical Co.
Canadian Anilines & Chemicals Ltd.

Caustic Soda Plant—
The Dorr Company

Chemical and Consulting Engineers
The Dorr Company
Donald, J. T. & Co.
Dorr Company
Ernest Scott & Co.
Fitzgerald Laboratories.
Gilbert Laboratories
Stillwell Laboratories.
Associated Geological Engineers.
Process Engineers, Limited
Palo Company
Samuel M. Green Co.
Toronto Testing Laboratory
James, Loudon and Hertzberg.
George Taylor Hardware Ltd.
Ruggles-Coles Engineering Co.
E. J. Young

Cobalt—
Coniagas Reduction Co.
Deloro Smelting & Refining
Keeling & Walker, Ltd.

CLASSIFIED INDEX OF ADVERTISEMENTS—*Continued*

Index of Advertisements

EMPLOYMENT DEPARTMENT

The charge for condensed advertisements of "Engagements Wanted," or "Positions Open," is 50 cents per month for advertisements of 40 words or less, no charge being made for the use of box numbers in care of CANADIAN CHEMICAL JOURNAL.

ENGAGEMENTS WANTED

CHEMIST, familiar with gun-cotton, powder, TNT, nitric and sulphuric acids. Experienced in analysis of acids. Capable manager. Box 5, CANADIAN CHEMICAL JOURNAL.

POSITION wanted by an analytical chemist, University Graduate in Chemistry. One year's experience in large laboratory. First-class references. Apply Box 2, CANADIAN CHEMICAL JOURNAL.

Graduate chemist, experienced in steel, explosives and organic research, desires change. Good organizer and efficient manager. Apply Box 19, THE CANADIAN CHEMICAL JOURNAL.

A young engineering student desires a position in a chemical laboratory. Complete high school education as well as two years at Toronto University in the department of chemical engineering.—Box 16, CANADIAN CHEMICAL JOURNAL.

POSITIONS OPEN

Industrial concern located three hours from large city, wants immediately a young graduate chemist (man or woman) for analytical work. Must have good experience in routine analysis. Application forwarded to Box 14, THE CANADIAN CHEMICAL JOURNAL. State salary wanted.

CHEMISTS FOR MUNITIONS WORK

The Imperial Ministry of Munitions require the services of Analytical Chemists who are ineligible for Military Service, or who are not in the first class. Applications from ladies with a knowledge of Chemistry will be considered.

Apply to THE DIRECTOR OF INSPECTION,
Imperial Ministry of Munitions,
OTTAWA

Process Foreman in T.N.T. Explosives or Acid mannfacture who desires to connect with a related industry which manufactures a commercial product can communicate with Box 17, CANADIAN CHEMICAL JOURNAL.

Large chemical works requires the services of several chemical Foremen who offer experience in some branch of process work. Must be accustomed to handling men. Good prospects in a permanent industry. State salary wanted and particulars on work you have engaged in. Box 18, CANADIAN CHEMICAL JOURNAL.

MACHINERY WANTED

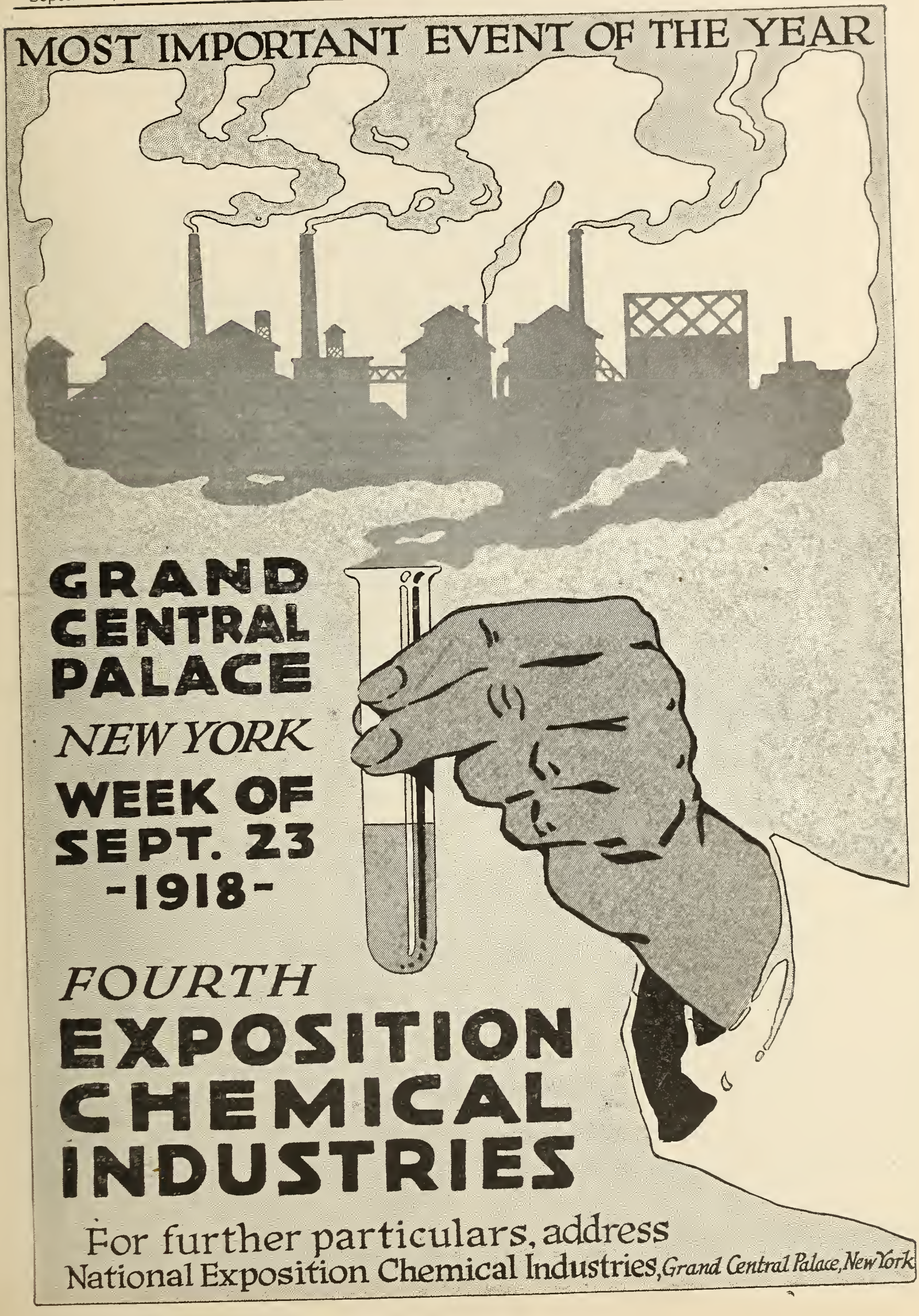
The advertiser wishes to get in touch with makers of plant for the production of Hydroflouric Acid. Address Box No. 1, CANADIAN CHEMICAL JOURNAL.

CANADIAN CHEMICAL JOURNAL

A Canadian Journal devoted to Metallurgy
Electro-Chemistry and Industrial Chemistry.

Vol. II, No. 9 TORONTO, SEPTEMBER, 1918 20c. a copy; $2 a year

PROFESSIONAL DIRECTORY


MOST IMPORTANT EVENT OF THE YEAR
GRAND CENTRAL PALACE
NEW YORK
WEEK OF SEPT. 23
-1918-
FOURTH
EXPOSITION CHEMICAL INDUSTRIES
For further particulars, address
National Exposition Chemical Industries, Grand Central Palace, New York

CANADIAN CHEMICAL JOURNAL

A Canadian Journal devoted to Metallurgy Electro-Chemistry and Industrial Chemistry.

Vol. 2 TORONTO, SEPTEMBER, 1918 No. 9

Canadian Chemical Journal

Devoted to the Chemical and Metallurgical Interests of Canada

Published monthly by the Biggar Press Limited

540-541 Confederation Life Bldg. - Toronto, Canada

E. B. BIGGAR Managing Director **L. E. WESTMAN, M.A.** Editor

Telephone Main 7399

Subscription price, $2, per year to Canada, United States and all parts of the British Empire; Foreign countries, $2.50 per year.

Time of going to press, 1st of each month. News and changes of advertisements should be in hand one week before.

PRINCIPAL CONTENTS

PROFESSOR S. F. KIRKPATRICK, of Queen's University, has accepted a position with the Deloro Smelting and Refining Co., of Deloro, Ont. Prof. Kirkpatrick was one of the scientists who developed the processes for producing stellite, which were first put into practice at Deloro. Another Queen's professor makes a move this month, Prof. W. O. Walker, of the Department of Chemistry, having been appointed Professor of Chemistry at McMaster University, Toronto, succeeding the late Dr. Tingle.

A REPRESENTATIVE of the CANADIAN CHEMICAL JOURNAL visited New York a few days ago, and found preparations well advanced for the National Exposition of Chemical Industries, to open in the Grand Central Palace on the 23rd September. More than ever before, the practical advancement of chemists and the education of the public are the aims of the exhibition commissioners this year, and having this in mind the attendance of Canadians will be even greater than last year. The chief features of the programme will be found on another page.

AN order-in-council has been passed prohibiting the export of casein or lactarene from Canada, except under license issued by the customs commissioner on the recommendation of the War Trade Board. In view of the success achieved by Canadian manufacturers of condensed milk, milk powder, etc., there are interesting possibilities in the manufacture of casein, which in times of peace would form a valuable adjunct to the growing paper making industry. The subject of casein is referred to in the report of the meeting of the Chemistry Committee of the Advisory Council.

THE ancient "schools of the prophets" are to be succeeded in Palestine by a modern university at Jerusalem. The declaration of Arthur Balfour on behalf of the British Government, that encouragement would be given to the movement for restoring this land to the Hebrew people, has been endorsed by President Wilson. The President, writing to Rabbi Wise, of New York, ex-president of the Zionist Committee, said all Americans would be deeply moved by the report that the Weizmann Commission had already been able to lay the foundation of the Hebrew University at Jerusalem. Dr. Weizmann is president of the British Zionist Federation and has been employed in scientific work by the British Government. This new seat of learning, founded in such remarkable circumstances, will have a department of applied science, including chemistry.

IN discussing the alcohol problem some months ago, we pointed out that even under an excise system which favored the modern distilling industry, the modest illicit still had never gone out of business in the rural districts of Quebec, and that these small stills were likely to be revived in Ontario, and in many remote parts of the other provinces as a means of evading the prohibition laws. This has already come to pass and the number of producers of "mountain dew" have already increased to an extent that calls for action by the authorities. In the United States the illegal distilling business is already more extensive than here, as is evident from the fact that a raid in the South has resulted in the seizure of 486 illicit stills. These private distillers are trying their best to uphold Byron's dictum that "man being reasonable, must get drunk," but the problem now is to enable the distillers to produce alcohol in such form as to feed the industries and not the human stomach.

THE CHEMICAL ENGINEER

OUR universities are opening again. The ranks of their staffs and their students are thinner in many faculties than ever. The already long lists of honored names grow longer. The nuclei of these institutions have a mission in remaining active through these years of war. They have a mission for the present which they are accomplishing and a mission for the future which they should study with care. What shall be the nature of those courses which shall be deemed most worthy in the changed conditions?

Courses in history and languages other than those specialized in previously may receive more attention. The applied sciences may attract even more than they did before the war. In this connection, it would appear only natural from the course events have followed that more students should be attracted to the general subject of chemistry in its many branches. Should this not be the case, our universities would be failing to keep faith with those industries that have so generously supported the fundamental fabric of the whole national effort up to the present time.

As a class, it has always appeared that engineering students were less fitted to enter as individuals into the general practice of their profession upon graduation than any other type of university graduates claiming to have followed a special course. If this is in any sense true of engineers in general it is especially true of that particular individual who, upon graduation, calls himself a chemical engineer. Very few students indeed have been able to substantiate this nomenclature on their own behalf immediately upon graduating, especially if they have been called upon to really prove themselves. Now the term chemical engineer has been made the subject of much discussion and vain definition. It is readily granted that the principles of chemistry and engineering play such a fundamental part in all our modern industries that it would be impossible for any student to obtain practical knowledge of more than a very few of these in anything like a normal length of time. At the same time, it would seem as if our universities might make a better attempt than they do to turn out something more approximating a real chemical engineer if the heads of various departments really set themselves this task. To begin with, the length of the course should be increased beyond four years. This extra time might well be spent in part, at least, in detailed surveys of the best practice in type industries. The student should have a broader, more balanced, and fundamental view of the whole field before he goes out to his first special job. The student will be lost in any event, but he should not be so utterly useless as he generally is at this stage. It often happens that students who have followed so-called courses in chemical engineering obtain positions where they apply only such slight knowledge of analytical chemistry as they may have picked up while an engineer follow ing some other course, bungles through a problem for which in the most part he had received no special chemical training.

So it is that many men are lost right at the start. There never was a time when both here and in England there existed such an opportunity for chemical engineers to maintain and push forward the chemical industries of the country. If there could be more amalgamation of chemical staffs in connection with our universities, more opportunity given special lecturers to come from the industries for the benefit of students, more definite farming out of students during vacations, and in general more attention given to this specific problem now, doubtless our engineering staffs and industries would both benefit at a time when this special work needs the very best attention it can possibly receive.

A move in this direction should certainly follow as a result of the various war activities and as a means of continuing what has been started under such favorable conditions.

THE GUILD IDEA IN INDUSTRIAL RESEARCH

THE growth of direct Government assistance in industrial research has passed through more than one phase already, since its inception in Canada. The fundamental information obtained through the method of addressing questionnaires to universities and industries proved to be of very little importance and negative in constructive value. There were exceptional cases, but the whole industrial fabric of the country did not unfold itself to this method of approach. It was found that few firms were carrying on any research work in the sense that the Government had in mind. The average firm was willing to

buy anything that worked, but never conceived it possible for them to be leaders in experimentation. The larger industries were quite capable of looking after themselves and believed in their own efficiency more than they did in Government co-operation, and above all, were not particularly anxious to assist their less fortunate competitors before they held a majority of their stock. In other words, human nature did not change suddenly at the approach of the questionnaire. It was, however, the only logical thing to do first.

Government assistance must necessarily be thought of in general terms. It was only natural to expect that the functions of the Advisory Council for Scientific and Industrial Research would change and multiply as the work proceeded and as growth took place. It became obviously necessary to do more than advise and readjust the spontaneous and haphazard work of individuals. From the national viewpoint it was not sufficient that a few larger and stronger industries should build up their own laboratories and advance themselves and their products. These successes may be the result of brilliant individual efforts, but they need to be considered as indicators of what could be done under more general application of the same principles, as far as the Advisory Council was concerned.

Now it is proposed that firms in various industries be grouped, and trade guilds established for more active co-operation along research lines. It is proposed that these guilds enter into partnership with the Government on the community research principle. A battalion of difficulties and problems in the smooth working out of any such scheme present themselves. And yet again this seems a logical treatment of the situation from the standpoint of the Government. Most of these guilds would be expected to support their own research laboratories without much continued Government assistance. Weaker and younger industries would receive more substantial Government support. It is presupposed that work undertaken would bear a general relation to the industry, and would be of general value when brought to a conclusion. As a keynote to this outlined plan a Central Research Institute is conceived, incorporating within itself a Bureau of Standards, the services of which would be free to all industries.

It is hardly right to compare such a proposed scheme with anything in existence in America or Europe. The plan is so broad in its conception that if carried out in detail it would constitute a new advance on the part of the Canadian Government beyond anything undertaken so far in any other country. This would be better considered perhaps as a virtue than as an objection. Other governments have assisted and correlated scientific industrial effort, but the growth was more gradual and was not based on any such sweeping premeditated initial program.

The control of large industries in the United States and other countries by a few executive heads has made possible the building up of very complete and successful industrial research laboratories working in the interests of certain industries. Where the capital of the industry has been controlled by a fairly large number of independent firms, united effort along research lines has not prospered to the same extent, or has dwindled down to the lesser level of analytical control of established operations. In such cases, there is an opportunity for government stimulation and it is this field that the proposals of the Advisory Council are designed to reach in particular. Where agricultural or fishing industries are considered, we have the extreme case. The capital invested may be considered as having suffered infinite dilution and we find that industrial research along such lines is already almost entirely in the hands of various governments and must be supported through the public treasury by the work of public servants.

It has been pointed out that the Mellon Institute of Pittsburgh best represents in part the successful application of this idea. There are certain fundamental differences however, between any existing industrial research institution, and the plans at present under consideration by the Advisory Research Council. These laboratories, from the viewpoint of the industries or firms they serve, are in no sense charitable institutions. Their first care is to think in concrete terms for one particular firm connected with a certain industry. No doubt some of the problems worked out in such places make exceptions to this rule, but the rule holds. In the agreement between the firm and the industrial laboratory, special care is taken that the results of work accomplished shall not be of any value to other competitors in the same business. This is the aim at least, and if general results of value are obtained, they are not given out until such time as the firm establishing the research is well on its way towards its application or has completed its patent rights. As pointed out, some companies are large enough to be entirely self containing. They are already beyond the point where ordinary government co-operation would be of much value or desirable.

General assistance producing general results, supposed to be of equal value to everyone, does not seem to be just what keen industrial executives have striven for in the past. If the government proposes to lead a guild in special research, it must lead so well that no firm will meet an undue measure of success by handling its problems through a private institute of research. It is conceivable that occasions may arise where a firm desires to exploit its own idea under cover and win or lose alone. In such cases, the Mellon Institute, or institutes of similar nature, will always possess appealing advantages. It would be well for the government, right at the start, to so modify its machinery that it might possess some of these advantages. Government effort along these lines

will be hampered by: lack of flexibility in action; the impossibility of overcoming seniority; ever present Civil Service examinations; non-technical superior heads; probable lack of funds and miserable salaries; no bonus system for success, and no dismissal for failure. These may seem trivial things when considering such a broad general program, but they are very essential details if the time is at hand when the Government sees fit to attempt to father the industrial research of Canada beyond the well trodden lines now established.

While the whole scheme of guilds for research is as yet only a possible proposal, there are many points that give it a strong appeal. Our industries are not yet so varied or complex but that they might be moulded into such a scheme. A definite opportunity would be created for those men whom it is proposed to train under assisted fellowships and scholarships. The competition in trade after the war will force weaker industries and firms to tune up their methods of working. The fundamentally unsound habit of hoarding antiquated trade secrets and rule of thumb methods would tend to be abolished, and a broader conception should develop among the men employed in any particular industry, which should assist in expanding trade.

Whether or not this proposed scheme meets with the approval of the leaders in various industries, remains to be seen. They should express themselves more freely than they do on matters of this kind. In any event, the Advisory Research Council proposes to give the industries of this country an excellent opportunity of pulling together for their own common good and the welfare of Canada as a whole.

FEATURES OF CANADA'S RESOURCES

The forests of Canada will furnish pulp in perpetuity for all the paper mills of the British Empire and the United States, assuming rational methods of forest administration.

The bituminous coal reserves of Canada are among the greatest in the world.

The output of asbestos in Quebec in 1918 will be over 100,000 tons, and is greater than that of any other country.

Of the world's production of nickel, Canada supplies over 80 per cent. If the sulphur fumes from the nickel smelters of Sudbury were recovered the production of sulphuric acid from this source alone would supply all the requirements of the country, and leave quantities over for export.

Near Madoc, Ontario, is the largest body of high grade talc on the Continent.

The feldspar areas of Ontario and Quebec contain potash enough to supply the requirements of the world.

Ontario contains the largest mica mine and the richest graphite mine in America.

In the region between Ottawa and Sudbury there are areas of molybdenite which when developed, will yield as great a percentage of the world's supply of molybdenum as the Sudbury ores yield in nickel.

The tar sand beds of Alberta are the greatest known in the world.

In one of the richest silver camps in the world in Northern Ontario, metallic cobalt as a by-product, is produced in quantities that aggregate over three-fourths of the world's consumption. The smelters at Deloro and Thorold (St. Catharines) refine more cobalt than all other refineries in the world, and through the genius of a Canadian and an American metallurgist, the new metal, stellite, a product of cobalt, is making a revolution in machine shop practice, as a cutting tool.

The deposits of titaniferous iron ores in Quebec are probably the largest in the world, and the electric smelting processes now make these ores available.

The newly explored copper areas of the Pas in Manitoba, give promise of being the most estensive yet found in America, the ore of one deposit being estimated by diamond drilling operations, at 25,000,000 tons. Canada's exports of copper ore will this year be about 150,000,000 lbs.

Before the new uses of platinum were discovered, large deposits of this metal were found in Southern British Columbia; but no use being then known for it in the days of placer mining, the location has to be re-discovered. It is believed this deposit rivals that of the Ural Mountains in Russia.

Of the water powers by which the mineral resources of Canada may be utilized, only 1,700,000 h.p. out of 17,500,000 h.p. that have been measured, have been harnessed. Much unknown, and therefore unmeasured, water power remains to be addded to this total.

CANADA'S SHARE IN THE GREAT WAR

The Director of Public Information has just issued an informing bulletin on "Canada's War Effort—1914-1918." From this the Canadian Chemical Journal will have available at the Chemical Exposition in New York, some statistics, but meantime, note that the number of the Canadian forces sent overseas up to the end of June was 383,523, exclusive of 67,043 in training to sail for the seat of war. The killed, wounded, missing and prisoners number 159,084. One whole army corps is now maintained at the front.

To supply her own troops and help those of Great Britain and the United States, Canada established 450 munitions plants which have produced 60,000,000 shells of various sizes and component parts of shells in brass, steel, etc, and totalling 670,000,000 pieces. In the production of these shells 1,800,000 tons of steel were used.

Explosives and propellants have been produced in Canada to the amount of 100,000,000 lbs. Capital invested in these explosives industries, $15,000,000; in other chemical and metallurgical industries since the war began over $100,000,000.

Steel ships to be launched this year 59, wooden ships 53; total tonnage, 446,000. Motor submarine chasers and other patrol vessels built or in course of construction 586.

STANDARD CHEMICAL IRON AND LUMBER COMPANY

The annual statement of the Standard Chemical Iron and and Lumber Company, of Canada, Limited, presents a gratifying record, both in the financial sense and in the matter of production. After a period of four years, during which no dividends were declared on preference stock, a dividend of 3½ per cent. on this issue of stock has now been declared. The sales during 1917 amounted to $4,322,056, being an increase of $800,000 over 1916. The reserve fund has a balance of $600,000 to its credit, and many important replacements and renewals have been made to the plant out of current revenue. As the largest producers of chemicals in Canada, this company has performed an important national service in directing its energies to the production of war chemicals, and in their efforts to render this national service the directors have placed their thirteen plants on a higher level of efficiency than ever before.

This company will have an interesting exhibit of samples of some of their special products at the National Exposition of Chemical Industries, the exhibits being made through the Ontario Bureau of Mines.

ELECTRO-CHEMICAL INDUSTRIES OF SHAWINIGAN FALLS

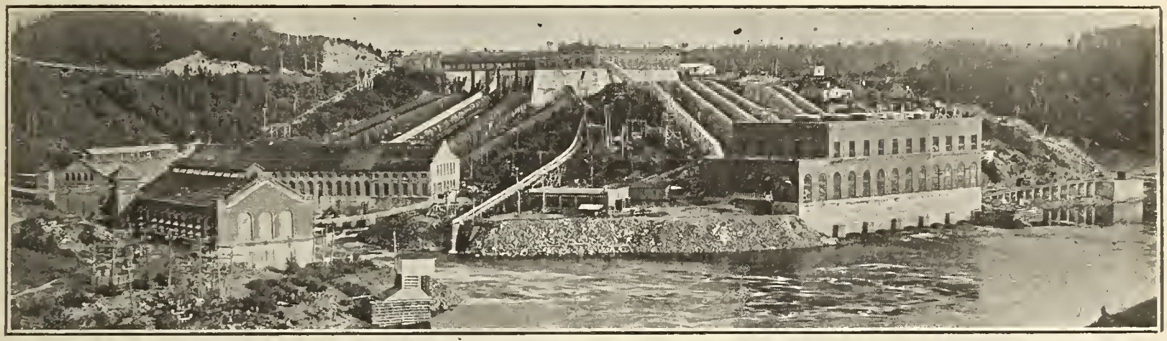
By H. E. Randall

Shawinigan Falls is located in the Province of Quebec, midway between Montreal and Quebec City, and derives its name from the Indian word indicating the resemblance between their beautiful quill and bead work and the great Falls of the St. Maurice River.

The city is of comparatively recent origin, having been until 1898 a wilderness, many miles from the nearest railroad. That year marked the commencement of the development of power at the Falls of the St. Maurice River, which are 150 feet high at this point and offer one of the most remarkable natural power developments in the world.

Since 1900 the growth of the city has been extremely rapid, because, with the coming of the Canadian Northern Railway and the Canadian Pacific Railway, the products of immense electrochemical plants, which could obtain cheap power near the falls, were able to cheaply reach the world's markets.

Twenty miles below Shawinigan Falls lies Three Rivers, at which point the St. Maurice River enters the St. Lawrence River. Three Rivers is on tide water, and having many miles of docks, capable of docking any vessel navigating the St. Lawrence River, makes a most satisfactory export shipping port for the industries which have grown up at Shawinigan Falls.



SHAWINIGAN POWER DEVELOPMENT

Power Supply

The basis for the electro-chemical developments at Shawinigan Falls is, of course, the large amount of hydro-electric power which is available at remarkably low prices. The Shawinigan Water and Power Company, which owns the power developments at this point, has at present installed in its generating stations at Shawinigan Falls and Grand Mere, Que., 330,000 horse power, of which 265,000 horse power is electric power, the balance of 65,000 horse power being sold as hydraulic power to certain of the local industries at Shawinigan Falls. While this amount of power is capable of supplying all of the present requirements of the district, and provides a considerable amount of power which is now available, the Shawinigan Company further owns the Gres Falls, six miles below Shawinigan Falls on the same river, at which point 75,000 horse power can be developed as soon as required. Moreover, at Grand'Mere, nine miles above Shawinigan Falls, provision has been made for the addition of 60,000 horse power more, and as the foundations have been prepared for this additional capacity, it can be obtained upon relatively short notice. The electro-chemical industries at Shawinigan Falls are, therefore, assured of an abundance of hydro-electric power, not only for to-day, but for a considerable time in the future.

Shipping Conditions

Shawinigan Falls is served by two railroads, the Canadian Northern Railway, and the Canadian Pacific Railway, both of which make connection with the National Transcontinental Railway, a few miles from Shawinigan Falls. All switching to the various industrial plants is done by the Shawinigan Falls Terminal Railway, so that switching is conveniently and cheaply obtained and the facilities of each railway equally placed before all of the industries. Three rivers, twenty miles from Shawinigan Falls, is situated on tide water, and will offer after the war, when shipping restrictions are reduced, an ideal export shipping port for seven months of the year. During the winter months, when the St. Lawrence River is frozen over, export shipments are made from St. John or Halifax. Three Rivers also offers an ideal shipping port for serving the Great Lakes trade, so that—especially in summer—Shawinigan Falls industries are placed very advantageously with respect to ocean and lake shipping.

While it is difficult to discuss export shipping rates at the present time, it is nevertheless true that in normal times averaging a large number of the ordinary heavier electro-chemical products, a differential of \$2 per ton exists in favor of Shawinigan Falls in summer, and \$1 per ton in winter, over Niagara Falls, which city is taken as representing the greatest electro-chemical centre on the continent. These differentials will, of course, only apply to products which can be exported to ports reached by the Canadian sailings, which in general are satisfactory for supplying the European trade. If products are destined for ports not reached by Canadian sailings, it will in general be cheaper to use New York as a shipoing point, in which case a differential of between \$1 and \$2 per ton exists in favor of Niagara Falls.

Raw Materials

Bituminous coal in normal times is obtained from Nova Scotia, costing normally (pre-war) \$3.20 per ton on wharves at Three Rivers. Anthracite coal is got from the United States' coal fields. Coke to the amount of about 200,000 tons per year is made at Montreal, largely from West Virginia coal, and can be obtained at very favorable prices. Petroleum coke to the amount of about 5,000 tons per year is manufactured at Montreal, about one-half being made from mid-continent crude oil and the balance from Mexican crude oil. Tar to the amount of 3,000,000 gallons per year is produced by the Montreal Gas Company, which is refined and from which 15,000 tons of pitch per year are available. High grade limestone, quartz and sandstone are available in large quantities near the St. Maurice Valley. Chromium and titanium ores are found and mined commercially within one hundred miles of Three Rivers, as well as zinc, magnesite and other minerals.

Excellent shipping and railroad facilities, putting Three Rivers and Shawinigan Falls in touch with the world, make the supply of those raw materials required for particular processes a relatively easy problem for the manufacturer.

Labor Conditions

The St. Maurice Valley is essentially an agricultural community and being largely populated with the thrifty and home-loving

French race, there is available on the markets of the industrial centres, food products at very fair prices, which is an essential condition in maintaining stable labor conditions. The large families which are common in the Province, furnish practically all of the labor required in the industrial centres, and this labor, being French and thrifty, settles down and readily becomes a permanent part of an industrial community. The amount of labor available in the Province is very large, and is of the kind adapted to industrial work, to which statement the large New England industrial centres of Manchester, Fall River and Lawrence bear witness, as the population of these cities is largely made up of French-Canadian people from the Province of Quebec. It is remarkable that in spite of present-day conditions, no strikes or other great evidences of labor unrest have ever been found in the Shawinigan Falls-Three Rivers district. The natural traits of the French people, their thrift and frugality, make labor conditions in the St. Maurice Valley exceptionally satisfactory to the manufacturer.

Growth of Shawinigan Falls

The first electro-chemical industry to establish itself at Shawinigan Falls was the Pittsburgh Reduction Company, now the Northern Aluminum Company. Soon afterwards the Canada Carbide Company was started, and in 1905 the Belgo-Canadian Pulp & Paper Company built their first mill. These industries expanded rapidly to many times their original proportions, but no other industries were established at Shawinigan Falls until 1914. During this period a very large market for the power generated by the Shawinigan Water & Power Company was built up throughout the Province of Quebec, transmission lines being built to serve all the larger cities of the Province and over a hundred of the smaller towns. In 1915, however, a very large addition to the generating capacity of the Shawinigan Company was completed, and this, with the great demand for power existing throughout the country and the inability of manufacturers to obtain power, made the growth of Shawinigan Falls extremely rapid from that time on. The population of Shawinigan Falls in 1912 was about 8,000; in 1918 its population had increased to 14,000. This great increase in population was brought about by the influx of labor from the surrounding territory for the new electro-chemical plants constructed since 1915, descriptions of which are given later.

The Northern Aluminum Company is located outside of the electro-chemical district, but adjacent to the power developments of the Shawinigan Company. This location was chosen on account of the fact that the Aluminum Company utilizes hydraulic power for their works rather than the electric power of the Shawinigan Company, although a considerable amount of electric power is now purchased by them. Their works, of an extensive nature, cover about fifteen acres of ground and contain, beside the reduction rooms for the production of aluminum, an ingot room and a rolling mill and a wire drawing and cabling plant.

Present Electro-Chemical Industries

The Canada Carbide Company occupy some fifteen acres of land in the industrial district. The company employs some 500 men and manufactures calcium carbide and acetylene gas only, and utilizes some 50,000 h.p.

The Shawinigan Electro Metals Company, whose plant was constructed and put into operation in 1915, produces metallic magnesium in many forms and occupies about five acres with their various processes. They utilize about 2,500 h.p. in both alternating and direct current furnaces.

The first plant of the Canadian Electrode Company was constructed in 1915, but since that time two additions to the plant have been made, so that the present capacity is about four times the original capacity. This company manufactures the larger sizes of carbon electrodes for electric furnaces and have an output of about 30 tons per day. The majority of the output is used in Shawinigan Falls, although a considerable tonnage is exported.

The Canadian Electro Products Company manufacture acetic acid, acetaldehyde, paraledehyde, acetone and other similar products from acetylene gas supplied by the Canada Carbide Company. This plant, while primarily constructed for the purpose of supplying acetone and acetic acid to the British Government, has so demonstrated its possibilities that it will continue to be one of the most important industries at Shawinigan Falls when the war is over.

The Prest-O-Lite Company constructed in 1917 a plant for compressing acetylene gas for charging Prest-O-Lite cylinders. This gas is purchased from the Canada Carbide Company, near whose plant the Prest-O-Lite works are located.

Fraser, Brace & Company in 1917 erected a small electric furnace plant of about 1,000 h.p. for the manufacture of low phosphorus pig iron. This plant has been very successful and is now being expanded into a considerably larger industry.

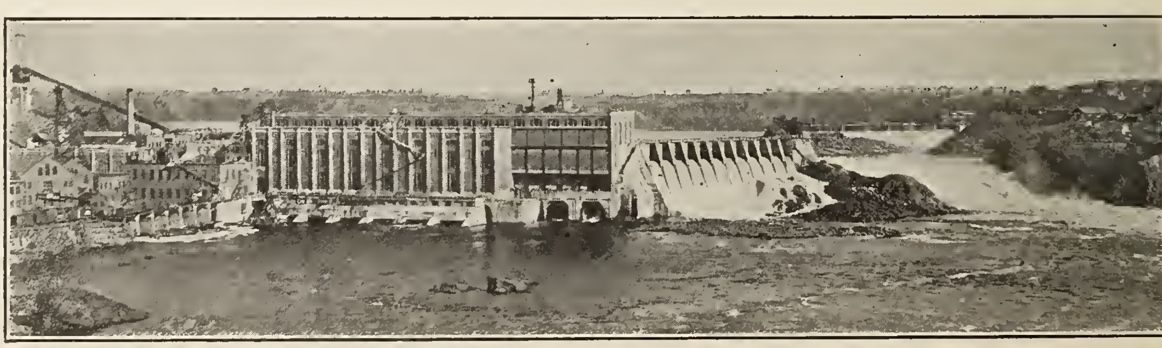
In 1917 the Canadian Aloxite Company, a subsidiary of the Carbide Company, erected a plant covering about fifteen acres of land near the upper end of the electro-chemical district.

In these works the company utilizes over 20,000 h.p. for the production of such electric furnace products as aloxite, carborundum and ferro-silicon.

During the summer of 1918 the requirements of the United States Government for acetic acid led to the establishment of a plant practically duplicating the Canadian Electro Products Company's plant and erected adjacent to the same. This plant, owned by the American Electro Products Compny, will be operated by the Canadian Electro Products Company for the production of these chemicals on behalf of the United States Government.

The latest addition to the Shawinigan electro-chemical district is the Canadian Ferro-Alloys, Limited, who have constructed a plant near the Canada Carbide Company for the manufacture of ferro-silicion, and utilize some 10,000 h.p. for this purpose.

While not electro-chemical, two industries in the Shawinigan district are worthy of mention on account of the large amount of



LAURENTIDE POWER HOUSE

power they consume—the Laurentide Company at Grand'Mere, utilizing 28,000 h.p. for the manufacture of paper and pulp, and the Belgo-Canadian Company at Shawinigan Falls, utilizing 18,000 h.p. for the same purpose.

General Conditions

The St. Lawrence Valley, being tempered by the large mass of water moving from the Great Lakes to the sea, has a very steady and pleasant climate. The Shawinigan district has a mean annual temperature of about 50 Fahrenheit, the days being hot in summer, but the nights cool. The winters are rather long and cold, but the air is dry and great variations in temperature do not take place rapidly, so that to many the winter season is the most enjoyable of all the year.

Shawinigan Falls, like other large, rapidly growing communities is somewhat hampered at the moment by the lack of housing facilities, but houses are being rapidly built and will no doubt keep pace with the increasing population. As an indication of the stability of the labor, it may be noted that a great number of the houses in Shawinigan Falls are owned by the workmen themselves.

There is a technical institute in the city having some 150 students and equipped with fine modern laboratories housed in modern buildings. This institute offers a means of education to the younger men in order that they may be more fitted for the industries existing in the community and its night courses, which are well attended, aid workmen to become more useful and to become foremen and superintendents.

As the community is quite new, large amounts of land are available for industries, and in general sites may be found lying between the two railroads, so that siding facilities may be had on each. There is no difficulty in obtaining water from the river for industrial purposes, and this water is of such character that it can be used for the majority of industrial works.

The St. Maurice River water is not used for drinking purposes below Shawinigan Falls, and as the salt sea water is met a few miles below Three Rivers, very little, if any, objection can exist to stream pollution from industrial plants.

Shawinigan Falls as an Electro-Chemical Centre

If we examine the reasons which have made Shawinigan Falls such an important electro-chemical and industrial centre, we find that they may be summarized as follows:

1. Large amount of power actually available at low prices.
2. Cheap labor of a very satisfactory character.
3. Low import rates for ocean-borne materials..
4. Low export freight rates.
5. Reasonable coal costs.
6. Raw materials near at hand.

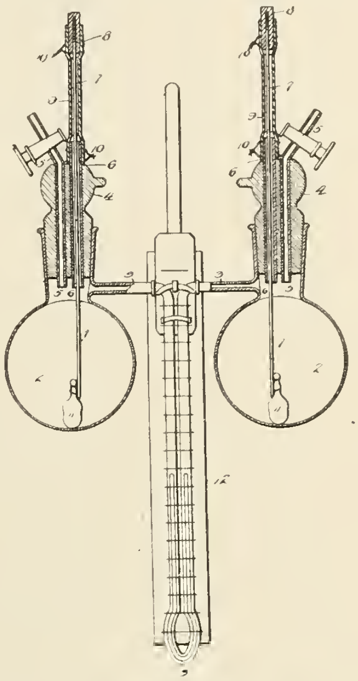
These reasons, which have built up the Shawinigan Falls of to-day, will, in the opinion of the writer, be just as strong in the future, and as a result the number and size of the electro-chemical industries at Shawinigan Falls must increase. Shawinigan Falls, with 100,000 horse power now available, and with several hundred thousand horse power yet untouched, offers a strategic location for serving the export market, the future basis of business At the present time, Shawinigan Falls is one of the few localities in the country where power in quantity can be obtained quickly and cheaply, and where the necessary labor for plant operation can be obtained without excessive importation.

With these present advantages and future possibilities, the Shawinigan Falls of the future will doubtless continue to be the electro-chemical centre of Canada, if not of all North America.

The Pfaudler Company, Rochester, N.Y., has appointed Lawrence C. Stahlbrodt to take charge of its publicity department. Mr. Stahlbrodt was originally educated in chemistry, but has been engaged for the past six years in publicity work. He was last connected with the Hurst Engraving Company. of Rochester.

PROCESS FOR ESTIMATING VAPORS IN GASES

Dr. H. S. Davis and Mrs. Davis have patented a process for the quantitative estimation of vapors in gases by the determination of their partial vapor pressures. The process is carried out in an apparatus of the form illustrated in the accompanying drawing which represents a vertical section of the apparatus and in which two flasks 1, 2 of about 300 cc. capacity are connected by a manometer tube 3, sealed into their necks. Into the neck of each flask is ground a glass stopper 4.4. Through each of the ground glass stoppers pass two tubes. One of these, 5.5. is closed at the upper end by a stopcock. Through the other, 6.6, which terminates about 1 cm. above the stopper, a metal rod, 7.7, passes to the bottom of the flask projecting above the stopper to a distance of about 11 c.m The upper end of this rod is screwed into a short piece of metal rod of larger diameter, 8.8. Over this larger piece of rod and extending down over the glass tubing projecting above the stopper is slipped a piece of tightly fitting



rubber pressure tubing, 9.9. The rubber joints are made tight by means of vacuum grease and wire, 10.10, 10.10.

To the bottom of the metal rod a small sealed glass bulb, 11.11, is attached by means of small supports and fine copper wire. This bulb, which has a thin bottom, contains sealed up within it some of the liquid whose vapor is to be determined in the gas in question. By pushing down the rod at the proper time or by giving it a slight tap, the bulb at the end can be broken, thus liberating the liquid it contains. The rubber tubing then draws the rod back into place.

The manometer tube may be filled with mercury or any suitable liquid and any difference in pressure in the two flasks can be read directly on a glass scale 12. When mercury is used for the manometer liquid, 1 mm. is a convenient size for the bore of the manometer tube.

It is not necessary that the tubes 5.5 pass through the stoppers, they may be attached to the necks of the flasks or any place where, by opening the stopcocks, the pressures inside and outside the flasks can be equalized.

The actual dimensions of any of the parts of the apparatus can be varied within wide limits; but, as will be seen from what follows, in order to obtain accurate results quickly, it is essential that when the bulb of liquid is broken in the bottom of the flask its vapor should quickly penetrate all the interior of the flask; hence, local pockets in the interior surface into which the

vapor would diffuse only slowly should be avoided and all connecting tubes should have a small volume compared with the total volume of the flask.

The theory of the method is based upon the prinicple often called Dalton's law of partial pressures, according to which the vapor pressure from a liquid is independent of the kind of gas above it, provided the gas is inert. Suppose the two closed flasks described above are filled with an inert gas at atmospheric pressure. If now a small sealed glass bulb containing a quantity of the same liquid is broken in each, the liquid will partially evaporate and will add its vapor pressure to the pressure already existing in the flasks: and if the temperatures of the flasks remain the same, the same additional pressure will be developed in each so that the manometer connecting them will record no difference in pressure. Even if the temperatures of the flasks do change no difference in pressure will be recorded until there is a relative difference in temperature between them.

Now suppose that one of the flasks had contained a certain pressure of vapor of the same composition as the liquid in the sealed bulb, and that this pressure was less than the saturation pressure at that temperature. When the small bulb of liquid was broken in this flask, the liquid would not add all its vapor pressure to the pressure already in the flask for part of that pressure was already due to its vapor. It could add only the pressure required to bring its vapor pressure up to saturation; and since the total saturation pressure was added to the inert gas in the other flask, the manometer connecting the two would register a pressure equal to the pressure of this particular vapor in the original gas.

Each of the sealed bulbs must contain considerably more liquid than it is required to saturate, at that temperature, the atmosphere in the flask into which it is broken with the vapor in question.

Two important points should be noticed here—The partial pressure of any particular vapor in a sample of gas is independent of the temperature of the gas, provided that the total pressure on the gas remains constant while the volume can change with the temperature and provided the vapor remains always unsaturated and obeys the simple gas laws.

Second. The difference in pressure developed between the two flasks, one of which contains inert gas and vapor and the other inert gas free from vapor, will vary as the absolute temperature, provided the relative temperatures of the flasks remain the same. That is, for practical purposes the difference in pressures is independent of the temperature.

An apparatus constructed on this principle will therefore measure a definite quantity, the pressure of any particular vapor in the gas at a definite gas pressure.

An actual determination of the pressure of a vapor in any particular gas is carried out in the following way—

One of the flasks is filled by displacement with the gas and the other with pure air containing none of the vapor. When the temperatures of the gases in the flasks have become the same, the stopcocks on both sides are opened to bring the gases to atmosperic pressure, after which they are closed. Next the small sealed glass bulbs containing liquid of the same composition as the vapor are broken by pushing on the metal rods and the apparatus is allowed to stand with occasional shaking until the manometer levels cease changing. In the case of the determination of the amount of benzene vapor in a gas the time required to reach equilibrium was 5-10 minutes for flasks of 140 cc. capacity and 10-15 minutes for those of 340 cc. capacity.

If greater accuracy is required, the determination may be carried out with the apparatus submerged in a thermostat and correction should be made for the change in volume in the flasks due to the movement of the manometer liquid. For ordinary work this is quite unnecessary.

The differential pressure which developes between the two flasks is equal to the original partial pressure of the vapor in the gas, when the total pressure on the gas is equal to the atmospheric pressure at the time of the experiment. This can be reduced to standard conditions in the following way.

Let P be the atmospheric pressure at the time of the experiment.

Let P_o be normal atmospheric pressure = 76 cm. of mercury.

Let X be the differential pressure developed between the flasks.

Then

$$\frac{XP_o}{P}$$

is equal to the partial pressure of the vapor in the gas when the total pressure on the gas is Po. As was pointed out before, the value

$$\frac{XP_o}{P}$$

is independent of the temperature provided every component of the gas remains unsaturated.

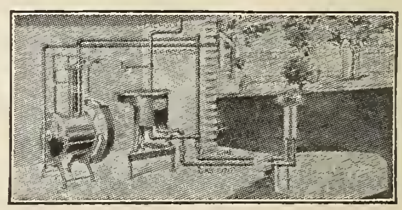
In a similar way the total of the partial pressures of two or more vapors may be reduced to its value for a total standard pressure on the gas.

COMBINATION GAS MACHINE

It will doubtless be of interest to our readers to know that The Detroit Heating & Lighting Co., Detroit, Mich., are manufacturing what is called the Detroit "Combination" gas machine.

This gas machine automatically manufactures from gasoline—without the use of artificial heat—a gas which is used for every purpose where public coal gas is used, and the cost is no greater. Among some of the many uses of this gasoline-gas is the operation of Bunsen burners in the laboratory, blast lamps, muffle furnaces, boiling liquids and in a machine shop for annealing, tempering, soldering and other uses.

The Detroit "Combination" gas machine is a very simple machine, comprising an air blower (either in the weight or water driven type), an automatic mixing regulator which is usually located in the basement of the building, and a carburetor or generator, which also serves as a storage tank, and is usually located about 30 feet from the building and buried underground.



This plant uses gasoline as fuel. By observing the illustration of the machine we will notice the air blower, which is either weight-driven or water-driven, takes air from outside and forces it through the carburetor or generator where it passes over the surface of the gasoline in the various cells, two, three or more, depending upon capacity of machine—the gasoline exposed to the air vaporizes in the form of gas and is returned to the combination mixing regulator, where it is diluted with air and delivered to the burners in a fixed quality.

The weight and water driven machine differs only in respect to air blower. The weight type requires an occasional winding, the water driven is automatic.

The Company advise us that these gas plants passed the experimental stage long ago, that they have over 30,000 in daily use, the pioneer machines having been made 50 years ago.

The Detroit Heating & Lighting Co., Detroit, will be glad to send a general catalogue describing the plants in detail. This is a very elaborate catalogue. It is not only a complete treatise on the manufacture of cold-process gasoline-gas, but it gives names of users of these plants in practically all parts of the country, thus enabling intending purchasers to see plants in operation.

MONTREAL LETTER

(Correspondence of the Canadian Chemical Journal, By J. C. Ross.)

MONTREAL, Sept. 14th, 1918.

There is still no improvement, either in regard to the availability of supplies or in the removal of restrictions regarding the securing of chemicals. As a matter of fact, with one or two exceptions, the hand-to-mouth policy commented on for the past two or three months, still prevails, while the restrictions in regard to embargoes are on the increase and are making it still more difficult to secure the necessary supplies.

The one exception seems to be logwoods. Dealers are getting all that they want at the present time, but warnings have been sent out that there will be difficulty in obtaining needed supplies in the future. The United States Government is restricting the export of the manufactured product to such an extent that there will be little or no supplies available in the near future. One prominent dealer stated that it would be wise for intending purchasers to lay in their supplies as soon as possible; not only will prices be higher in the future, but goods will be almost unobtainable at any price.

In connection with caustic soda, it is now impossible to get an export license to bring goods from the United States. This adversely affects soap makers, textile manufacturers, steel companies and enamellers. Apparently "Uncle Sam" has come to the conclusion that his own steel makers and textile manufacturers need all that can be produced and is giving them first chance.

Bleaching powders are higher and are showing a tendency to reach still higher levels. In this also the U.S. Government is buying everything in sight, and according to the latest reports, that Government is preparing to take over the works. Soda ash is also very strong, with a tendency to make still further gains. As a matter of fact, all heavy chemicals are in such demand that prices are continually advancing, while the supplies are becoming more difficult to obtain. To a certain extent the same is true of pharmaceutical chemicals. It is surprising that dealers and consumers of chemicals are able to make as gratifying a showing as they are doing. The ordinary business man wonders how they can manage to keep going when supplies are restricted, prices climbing to new high levels, importations cut off and other difficulties piling up. Good business methods and a determination to make the best of difficult situations enable them to "carry on."

The hot weather in the United States has driven a large number of conventions to Montreal, where, it is popularly believed south of the Line, it is always cool. One of the most important to choose this city was the Newsprint Service Bureau of New York. Their quarterly meeting was held at the Ritz-Carlton a few days ago, and was largely attended by both American and Canadian pulp and paper men. According to a statement made by S. L. Willson, Vice-Chairman of the Pulp and Paper Section of the War Trade Industries of Washington, Canadian publishers would practically be forced to abide by the rulings made at Washington. He pointed out that the pulp and paper industry was an international one and legislative measures put in force in the United States, such as the recent one, reducing the size of papers, would automatically affect Canada. In a similar sense, legislation regarding labor, the supply of coal, etc., applied north of the Line as well as south of the border. Prof. C. T. Hamill explained the reason for organizing a pulp and paper course at Syracuse University in connection with the New York State College of Forestry. A new $250,000 building is now complete. In a range of 20 miles there are 18 pulp and paper mills to which trips can be made, and in which students may find summer work. The idea is to train technical men for the mills. One third of the technical men in the mills are said to have been trained in Europe. The course will contain fundamental courses in chemistry, forestry, and mechanical, electrical and civil engineering, and such other work as is needed in four years to give the essentials of general education. From Montreal, the delegates proceeded to the Quebec Forestry Branch Nursery, where they were received by Mr. G. C. Piche, Chief Forester. From there the party journeyed to Grand Mere, where Mr. Ellwood Wilson showed what was being done toward raising a forest crop on what would otherwise be unproductive land.

Canadian Gas Association

The 11th Annual Convention of the Canadian Gas Association was held in Montreal on the 22nd and 23rd inst., and was largely attended by delegates, not only by the Canadian delegates, but by many representative American engineers and gas experts. The following officers were elected:

President, C. C. Folger, Kingston, Ont.; 1st vice-president, V. S. McIntyre, Kitchener, Ont; 2nd vice-president, C. S. Bagg, Montreal; secretary-treasurer, George W. Allen, Toronto (re-elected). The executive committee was elected as follows: A. A. Dion, Ottawa; J. M. H. Young, London (the retiring president); Arthur Hewitt, Toronto; J. S. Norris, Montreal; J. P. King, Stratford, and E. H. Caughell, St. Thomas.

One of the interesting papers presented was that given by Mr. C. D. Slimpin, industrial engineer of the Montreal Light, Heat & Power Co., in which he showed the advances made in the use of gas, and the opportunities awaiting its development in peace and war.

His company had been given an opportunity to prove the usefulness of gas in the manufacture of shells, with such success that from working with one company their enterprise had spread to many others, and they had sold over half a million dollars worth of gas in this work already. Their sales of gas to-day amounted to about 360,000,000 cubic feet a year. One shell plant turning out 75 millimetre shells used gas for all work, requiring about ten million cubic feet a month in making 7,000 shells per day, later to be increased to 10,000 per day. In this way Canadian gas was being used as an offset to German poison gas.

After papers by Messrs. Arthur Hewitt, Toronto, and C. S. Bagg, Montreal, a paper was read by Mr. G. W. Allen, secretary-treasurer of the association, on "Possibilities Ahead of the Gas Industry." Mr. Allen pointed out that whereas gas companies were able to secure 66 per cent. of the possible fuel value of coal, without counting the large quantities of coke and other by-products of tar, the ordinary coal user did not get more than about 22 per cent. of the calorific value of the coal. These facts, he said, should prove of great value to the fuel controllers, as the further use of gas as a means of heat and power, for both house and power boiler installations would undoubtedly lead to a great saving of coal, which would, by securing greater returns from the coal consumed, relieve the increasing scarcity of that fuel. It was only a question of time before Canada would be unable to secure anthracite coal, owing to the cutting off of the sources of supply. When that time arrives, the value of coke and gas as fuels will be much more appreciated. He urged that bituminous coal should as far as possible be turned over to the gas companies, to make sure that, as far as possible, its greatest fuel values should be utilized.

A paper was given by Mr. E. H. Caughell on "Standardization and Inspecting of Gas Piping Installations." Mr. Caughell urged that pipes of standard sizes and capacities be used for gas installations, to secure more uniform results, and make inspection work more accurate. He advocated that this be taken up by the association, and after some discussion it was referred to the next meeting of the executive.

The will of the late Dr. Jas. Douglas, who died a couple of months ago, has just been probated. Montrealers and natives of this Province generally take a particularly warm interest in Dr. Douglas, as he was born in Quebec City, educated in this Province, and has always remained a warm friend of McGill and other educational institutions. It is interesting to note

that Dr. Douglas amassed a fortune of $20,000,000 in mining after he attained the age of 40 years.

The American Cyanamid Co., with plants at Niagara Falls, Ont., and at Warner, N.J., made public its financial statement in Montreal a few days ago. The Company was formerly engaged in the making of fertilizer, but last year turned their attention to the making of ammonia for military needs. Net profits for the year were $2,435,000 as compared with $638,000 and $58,000 for three years ago.

Allotments are now being made in this Province for coal for next winter. The City of Quebec has been granted 108,127 tons of anthracite, which is only 78% of what was consumed in that city in 1917. Most of the consumers are getting but 70% of their last year's requirements. This shortage is causing considerable concern, not only among the actual consumers, but also among municipal authorities and corporation heads. The probable outcome of it will be that special attention will be paid to the development of water powers, and that within a few years "white coal" will play an increasingly important part in the operation of factories, the heating of homes and in transportation affairs.

Dr. W. W. de Fvechnikoff of Moscow Municipal University, recently visited Montreal and inspected the Forest Products Laboratory and other institutions doing chemical research work. For the past year or more Dr. de Fvechnikoff has been inspecting explosive supplies for Russia, which were being manufactured in the United States. In Russia he states that they have a certain amount of research work being carried on in connection with chemistry of woods, and that it is their intention to develop a Forest Products Laboratory somewhat on the lines of the one at McGill or at Madison, Wis. The Doctor is a First Lieutenant in the artillery in the Russian Army, and is a real Russian, not a member of the Bolsheviki cult. From Montreal he returns to the United States.

The National Drug & Chemical Company are engaged at the present time in renovating their whole chemical factory. They have torn down the interior of the plant and are rebuilding it, so as to extend some lines of their manufacturing department.

In Eastern Canada the whole question of fuel is very much to the fore. Power companies are advocating the increased use of water power as a means to save coal. At the same time, the fuel shortage gives the power companies a talking point, which they are not slow to adopt. For example, the Southern Counties Power Company are pointing out in a series of advertisements that they are spending over a million dollars in the building of additional power plants in the Eastern Townships; that at the present time 46 municipalities are using power from their plant, and that some 1,200 customers are being served. Down in New Brunswick the fuel shortage has stirred the scientists and the business men to such an extent that a movement is on foot to harness the Bay of Fundy tides and use them and the reversing falls at St. John for power purposes. Recently Professor Archibald of the Acadia College, read a paper before a group of Maritime manufacturers, in which he outlined a scheme for harnessing the tides at an estimated cost of two and a half millions. He and his associates have already spent $25,000 in experiments, and according to his claim, the production of water power from the tides is a commercial possibility. He states that they would be able to supply electricity for manufacturing purposes at 1 cent per kilowatt hour, and that the cost to private consumers would be only one-third the cost of present electricity. The power could be transmitted in the same manner as in vogue at Niagara Falls, but over a much larger area; in fact, he stated that towns and cities within a radius of 300 miles could be served with this power. Professor Archibald is urging the New Brunswick Government to appoint a hydro-electric commission to take some action with regard to the matter.

The Ross Rifle Company, of Quebec, which has been idle for the past 16 months, has reopened. A new company was formed under the presidency of T. A. Russell, of Toronto, to manufacture army revolvers for the United States Government. By the end of this year 3,000 hands are to be employed. A new shipbuilding company has also been incorporated at Quebec, for the purpose of building steel steamers. A site has been secured on the south side, near Levis, and work will commence right away.

Mr. D. H. McDougall, formerly general manager of the Dominion Steel Corporation, has resigned that post to take over the presidency of the Nova Scotia Steel & Coal Company. He succeeds Mr. Frank H. Crockard. The latter came to Scotia a year ago from the Tennessee Railroad, Iron & Coal Company, but was apparently dissatisfied with conditions in Canada, and is leaving. Mr. McDougall's elevation to the presidency will probably mean a great deal for the Nova Scotia Company. Under his management, the Dominion Steel Corporation launched out in the manufacture of a whole series of by-products. In the old days, before the war, the company simply manufactured a few lines of steel products and produced coal and coke. Mr. McDougall brought about the manufacture of a half dozen or more by-products, such as toluol, benzol, napthalene, xylol, sulphuric acid, sulphate of ammonia and coal tar. It is well known that Mr. McDougall is an enthusiastic believer in the future of manufacturing plants which can utilize their by-products, and the general opinion is that he will immediately start Scotia on a manufacturing career somewhat similar to what he accomplished in connection with the Dominion Steel Corporation. Mr. McDougall is essentially a self-made man, beginning his business life as a pit boy in the Dominion Collieries, and working his way up to the general managership of the company. He is still on the sunny side of 40, so that he has many years of useful work ahead of him.

At the annual meeting of the Pharmaceutical Association of the Province of Quebec, a new council was elected, as follows: President, Mr. J. E. Barnabe; first vice-president, Mr. A. D. Quintin; second vice-president, Mr. L. E. Martel; treasurer, Mr. Donat Belanger; and councillors, Messrs. John E. Tremble, H. Lanouette, Pierre Leduc, R. Martineau, Geo. Langlois, S. Boulkind, J. E. Prevost and F. C. Delachevrotiere. The undermentioned passes in quarterly examinations were announced by the board of examiners: Admitted as student of pharmacy—E. H. Legendre, Leon Prairie, H. Ouimet, Miss A. Lefebvre, Miss J. A. Barnable, R. Goulet, A. Martin, Lucas Choquette. Passed on Letters—E. Ethier, J. H. Martin, G. Peltier, G. Levesque, P. Quintal, N. Boissinot, J. C. Taschereau. Passed on Sciences—Leo Houde, A. Gagnon. The following passed on all subjects but one, and will have to present themselves at the next examination: T. Lussier, W. E. Charland, L. Migneron, R. Gregoire, C. E. Pitte, L. Croteau, G. Blais, P. Quintal, P. Prenoveau, J. H. Martin, D. Selsky, J. H. Geoffrion, Geo. Labrosse, N. Hoichberg.

"Under the Ashburton Treaty, Canada has certain treaty rights which she is not disposed to abrogate." Such was the summing up of the arguments of the Hon. Hugh Guthrie, Solicitor-General in the Federal Cabinet at the meeting of the International Joint Waterways Commission, which met in Montreal on August 29th and 30th. Continuing, Mr. Guthrie said that the Government of the United States should have dealt directly with the Canadian Government; if such a proceeding had been adhered to in the first place the matter at issue would have been settled inside of a few hours.

"It was a mistake for the United States Government to present their side of the case through the Company seeking to build the dam near Massena, N.Y. Even at this date I would suggest to Judge Koonce that he get busy and wire his Government to approach ours. Within hours, not within days, he will receive intimation that the matter has been taken up."

The meeting of the International Joint Waterways Commission, held in Montreal, was to deal with the vexed question as to who shall control the waters of the St. Lawrence and whether private companies shall have the right to dam the river as they see fit.

The St. Lawrence Power Company, a subsidiary of the Aluminum Company of America, have made application for the extension of the Long Sault by means of a submerged weir of the jetty or deflected dyke in the southern channel of the St. Lawrence River. This was to be built at the mouth of the Power Company's canal at Massena, N.Y. They claim it was a war measure, as it would permit them to manufacture aluminum for the allies during the winter months. The company's contention was supported by Judge Koonce, who represented the United States War Industries Board. Opposed to them were the Dominion Government, the Canadian Commission of Conservation, the Shipping Federation, the Montreal Board of Trade, and various other bodies interested in the navigation of the St. Lawrence and in general in the power resources of the country. At the first day's session lengthy arguments were presented for and against the project. In this case the ablest engineers on both sides of the Line, shipping experts, lawyers and others argued pro and con. It remained, however, for the Hon. Hugh Guthrie to present the international aspect of the controversy. He stated to-day "That the Government of Canada is not disposed to play dog in the manger," and then urged that Judge Koonce take up the matter with his Government to have them deal direct with the Canadian Government. He stated that if this were done, not only would this one question be discussed on its merits, but the whole international power development at the Long Sault would be handled in a comprehensive and exhaustive manner. In his conclusion he said:

"We claim a Treaty right, that of the Ashburton Treaty. If the Commission has power to close this channel, it has power also to close the Detroit river or the St. Lawrence. Where is it going to stop? Treaties must be respected. The whole world is at war to-day because a nation in madness undertook to deny treaty rights."

It is very probable that as a result of Mr. Guthrie's stand the United States will take action and deal directly with the Canadian Government in regard to the application of the St. Lawrence Power Company.

Since the foregoing was written a delegation from the Dominion Cabinet has gone to Washington to confer with the U.S. Government.

CASEIN AS A BREAD IMPROVER

Dr. F. J. Birchard, Chemist of Dominion Grain Laboratory, Winnipeg, has laid before the Chemistry Committee of the Honorary Advisory Council for Scientific and Industrial Research a report on the question of introducing casein as an element in flour.

Dr. Birchard stated that commercial casein is a product which in normal times at least, is produced in large quantities, and which has found application in the most various industries. It is not used to any extent, however, as a food, although it is recognized as one of the most valuable of proteins from a nutritional point of view. The difficulty heretofore has been to find a suitable method of incorporating the casein with other foods in a form which was agreeable and palatable. It has now been found that a good commercial casein may be added to flour to at least 5% of its weight without materially impairing the baking value of the loaf. If the casein is of the best commercial grade, the flavor of the bread is scarcely altered in any noticeable degree, and in any case not disagreeably so. From a nutritional standpoint very little consideration is sufficient to show the very great increase in the value of the loaf to which casein has been added. Neither the gliadin nor the glutenin, which together go to form the gluten, and which compose almost exclusively the total protein content of the flour contain certain essential constituents in the proper proportions necessary for a well balanced protein, while on the other hand, at least, one other constituent is present in very great excess. Casein, however, contains these first mentioned substances in a much greater proportion and the latter substance in comparatively small quantities, so that as a result of the addition of the casein to the flour, the quality of the combined protein is very much improved compared with the original. Particular attention should be called to the fact that in casein we possess the most concentrated form of food which could be imagined. The addition of even 5% to the flour increases the actual protein content of the bread by about one half, while the actual value will be very much greater owing to the better quality as pointed out above.

The question of the cost of the added casein must also be considered. In normal times, good commercial casein may be purchased for about eight cents per pound, while at present sixteen and seventeen cents must be paid. Even at the higher price, commercial casein must be regarded as a very cheap source of protein since, with the exception of a small amount of moisture present (about 9 to 10%) there is no waste whatever. The addition of casein to the flour in the proportions named would perhaps add one-third to one-half cent to the cost of the loaf of bread, which is very small in comparison to the actual increase in nutritional value.

These considerations, combined with the fact that casein, owing to its excessively concentrated form, occupies such small bulk, and that it can be very easily transported, leads me to suggest the advisability of adding casein to the flour for supplying bread to the troops abroad. It appears to me to be worthy of a thorough trial, since the advantages to above outlines would appear at the present time to be very great.

Prof. Parker regarded Dr. Birchard's suggestion as very valuable, and recommended acting upon it.

Dr. Goodwin thought that one feature of Dr. Birchard's communication would commend itself. As a war ration casein is an obvious concentration of food, such as would enable a soldier or person to carry a very large increased amount of food with the same exertion.

Dr. Birchard said a process had recently been devised for preparing casein from buttermilk very cheaply. Enormous quantities of buttermilk had been, before the war, simply going to waste, and if utilized at all simply utilized in the preparation of glazed paper.

One factory in Philadelphia uses several car loads a day, which seems to be enormous waste simply for manufacturing coated paper. Something should be done to bring this to the attention of the public, so it could be utilized as a food, which is certainly much more important than in the manufacture of coated paper. He was informed that the United States Government had refused to allow casein to be used for paper in the United States. The Dairy Division of the Department of Agriculture might be induced to investigate or bring it to the attention of the committee on food control.

GAS PRODUCTION FROM WASTE STRAW

At the recent meeting of the Chemistry Committee of the Hon. Advisory Council for Scientific and Industrial Research, Dr. R. D. MacLaurin, Professor of Chemistry in the University of Saskatchewan, reported on experiments made under his auspices with a view to the use of the waste straw of prairie farms for the production of gas for light, heat or power.

In his report, Dr. MacLaurin said the primary consideration was to develop a practical process by which the farmer might use his own straw fuel in the form of gas. If the process should prove to be a commercial success, it would provide a solution of the fuel problem for the western farmer.

In the three prairie provinces about 20,000,000 acres are under crop and assuming that there is one ton of straw per acre, which is a conservative estimate, the amount of fuel would be 20,000,000 tons. One ton of straw yields about 11,000 cubic feet of gas, and when the gas is partially purified by washing, so that the volume is reduced to 10,000 cubic feet the thermal equivalent of the gas is approximately 400 B. T. U. Assuming that

30 per cent. of the gas obtained is required to carbonize a ton of straw, then from every ton there would be a surplus of 7,000 cubic feet. From 20,000,000 tons of straw at 7,000 cubic feet per ton and 400 B. T. U.'s per cubic feet the total energy would be 2,511,000 H.P. At the present time, wheat and flax straw is entirely wasted. Oat straw is used to a small extent where mixed farming is practised. If straw can be used as fuel in the form of gas, the fuel problem for the farmer will be solved as he can produce his own supply.

The inventor of the equipment for the production of gas from straw is Mr. George Harrison, of Moose Jaw. The equipment consists of a retort, scrubber, and gasometer. Many retorts of various sizes and shapes have been made. Experiments have been conducted on carbonizing straw after being baled at various pressures, and it was found that the time of carbonizing increased with the increase in density of the bale. Without discussing the details of this phase of the work the practical object aimed at is to construct a retort of such capacity and material from which 1,000 to 1,200 cubic feet of gas may be obtained in one operation lasting not longer than 30 minutes. This amount of gas would be sufficient for a daily supply of the average farmer, and would necessitate only one operation.

One of the most important problems has been the manufacture of material of suitable composition and thickness which could be easily worked into a retort and at the same time would be resistant to temperature, and other conditions in the combustion chamber. The commercial success of the process will depend in a large measure on the life of the retort, and much study has been given to this point.

The operation of the plant consists in filling the retort with baled or loose straw, and then the air-tight doors are closed and fastened by a clamp. The retort is heated by burning straw in the fire place below, and the flames completely surround it. When the temperature reaches about 250° C. the gas begins to come off, and continues until the temperature reaches considerably over 900° C. The gas passes from the retort to a scrubber, where it is washed, and then to a gasometer. The gas is very easily purified, and contains no impurities.

From every ton of straw there is obtained from six to eight gallons of tar and ammoniacal liquors, and about 600 pounds of carbon residue.

Replying to questions by Dr. Ruttan and Dr. Goodwin, Dr. MacLaurin said that while coal gas has a thermal value of 650 B. T. U.'s, straw gas has about 400 B. T. U.'s per cubic foot; and that the equipment described would cost $500. Owing to the increased cost of material, a new retort is being constructed which will weigh about one-third as much as the former one, and in this way it is hoped that the cost will not exceed the above stated amount.

As to the by-products or residue, it is doubtful if any commercial value can be attributed to it at present. The carbon residue can readily be burned as fuel, but the practicability of briquetting it is out of the question. A small quantity of nitrogen, potash and phosphorus still remains in the residue which would give it a small fertilizing value. The carbon residue is easily powdered, and resembels lamp black in appearance. It seems to make a very good paint, but this has not been tested out commercially.

The Niagara Falls Review states that the American Cyanamid Company at Niagara Falls, Ont., acting in co-operation with the United States Government, have been training men sent to the Falls by the Government, into a knowledge of the products turned out by the Company, and have released some of their own employees to go to the Muscle Shoals, Ala., plant, now being constructed under Government auspices. This plant is about four times the size of the Cyanamid plant at Niagara Falls, and will employ thousands of men. The new plant is known as the Air Nitrates Corporation.

FOURTH NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES

Present indications are that the Fourth National Exposition of Chemical Industries, to be held in Grand Central Palace, New York, September 23 to 28, will be the greatest exhibition of its kind ever held. Preparations for this gigantic exhibition are well under way and the advisory committee is working hard to make every department of the affair a success. The committee is composed of Charles H. Herty, chairman, Raymond F. Bacon, L. H. Baekeland, Ellwood Hendrick, Henry B. Faber, Bernard C. Hesse, A. D. Little, Wm. H. Nichols, R. P. Perry, H. C. Parmelee, G. W. Thompson, F. J. Tone, R. B. Wagner and M. C. Whitaker. Charles F. Roth and F. W. Payne are the managers.

Some sections of the South again are sending exhibits, and Canada is taking the opportunity of presenting the materials it has available for development by the chemist and financier. Technical and business men over the country should give heed to these exhibits since they will show how they can meet the war time need. A section for the Glass and Ceramic Industry has been added, with which the American Ceramic Society is co-operating.

Men prominent in the chemical and allied industries will speak on subjects vital to present conditions and needs. Dr. C. H. Herty and Dr. G. W. Thompson, president of the American Institute of Chemical Engineers, are to make opening addresses. F. J. Tone, president of the American Electrochemical Society; Dr. W. H. Nichols, president of the American Chemical Society, and several others are expected to make addresses. Dr. Joseph W. Richards will speak on "Ferro Alloys of silicon tungsten, uranium, vanadium, molybdenum and titanium." Dr. Richards is a member of the Naval Consulting Board. Theodore Swann, president of the Southern Manganese Corporation, will speak on "Ferro Manganese."

Regarding the program the managers write us: There will be a series of symposiums on the "Development of Chemical Industries in the United States, notably since July 1914." This will embrace the period since the beginning of the European War, which, because of its removing the source of supply for our domestic industries inspired the development of our own chemical industries that, now, when we ourselves have entered the war, are proving so efficient. This program is divided into a consideration of Potash Development, on which Mr. C. A. Higgins, of Hercules Powder Company, will speak of the operations of that compnay in its recovery from kelp; Mr. Linn Bradley, of Research Corporation, of its recovery from cement dust and other sources by electrical precipitation.

There are other symposiums on chemical engineering, acids, industrial organic chemistry, the ceramic industries, and the metal industries, and among the speakers are:

A. Hough—"Chemical Engineering in Explosives, T. N. T., T. N. A., Picric Acid and Nitrobenzol."

E. J. Pranke.—"Development of Nitric Acid Manufacture."

S. P. Sadtler—"Development of Industrial Organic Chemistry."

Geo. H. Tomlinson—"Wood as a Source of Ethyl Alcohol."

C. A. Higgins—"Kelp as a Source of Organic Solvents."

Alcan Hirsch—"Pyrophoric Alloys."

The American Ceramic Society which will hold its meeting at the Exposition on Thursday afternoon, September 26, has already upon its program the following:

A. B. Bleininger—"Recent Developments in the Ceramic Industries."

L. E. Barringer—"Manufacture of Electrical Porcelain" (illustrated by motion pictures).

H. Ries—"American Clays."

F. A. Whitaker—"Manufacture of Stoneware" (illuminated).

Following this meeting a series of motion pictures of the ceramic industries will be shown. The motion picture program, with the arrangement of which the Bureau of Commercia

Economics is again co-operating, carries forward the idea of the symposiums, and pictures will be shown of industries that have developed, in so far as they can be shown with propriety.

There will be shown a series of motion pictures depicting studies of lakes, water falls, and hydro-electric power possibilities. The development of some of these will be carried through the several stages of construction, generation and transmission of the power and its use in industrial operations. Films of several electro-chemical operations will be shown.

There will be pictures of many chemical, mining and related industries, the application of electricity and electrical equipment to industrial work. There will be pictures showing the alkali industries that will be shown the same day on which the potash symposium is held. The making of glass, pottery and stoneware pictures will be shown on Thursdsay, September 26. Pictures of the oil industries, petroleum, asphalt, fatty oils, soaps, paints, linoleum and oil cloth will be shown. In fact, every field of endeavor from the products within, upon and above the earth, with which chemistry deals will be shown. There will be a series of films depicting carelessness, the destruction of life, wealth and resources that show hazards and risks in industrial plants and how they may be overcome. The dangers of fire and explosives will be demonstrated, and the prevention of disease by vaccines.

The list of exhibitors of the exposition is a very complete one of the best firms among or supplying the chemical industries, firms who are placing their faith in the future of America and the men who are building to successfully conclude this war and to meet world trade competition after. Many of the exhibitors are supplying motion pictures that will be shown on the program.

There will be a Canadian section this year as the forerunner of a larger representation from the Dominion next year. The Ontario Bureau of Mines will make a display of the metallurgical and chemical products of the mineral industry of Ontario, as well as of the ores and raw materials from which these are derived The collection will include the following:—Gold ores from Porcupine, Kirkland Lake, Boston Creek and Munro Township. Silver-cobalt ores from the Cobalt Camp and Gowganda, also bar silver, metallic cobalt, metallic nickel, cobalt oxide, nickel oxide, nickel sulphate, stellite, arsenic, and other products of the Ontario refineries. Stellite is a cobalt-chromium-tungsten alloy coming into repute for making high speed cutting tools. Copper ores from Massey, Sudbury and Mine Centre; nickel-copper ores from Sudbury and Alexo; nickel-copper matte from Copper Cliff, and refined nickel from the new refinery at Port Colborne. The Mond Nickel Company, Limited, will make a complete exhibit of ores, matte from the smelter at Coniston, and nickel metal from the refinery in Wales. Iron ores will be shown from the Helen and Magpie mines, and briquettes from Moose Mountain; hematite from Yarrow, and magnetite and hematite from Eastern Ontario. In lead there will be samples of galena from Eastern Ontario and in zinc, of sphalerite and calamine from Long Lake. Molybdenite will be shown from various localities in Eastern Ontario, also molybdenite concentrates, ferro-molybdenum and molybdic acid. Samples of ferro-manganese from the Electric Foundries, Limited, Orillia, and quartz and ferro-silicon from Electro Metals, Limited, Welland, will be included. In non-metallic substances iron pyrites will be displayed from Eastern and North-Western Ontario, together with sulphuric and other acids produced from the same by the Nichols Chemical Company at Sulphide. High sulphur ore will be shown from the Queensboro mine by the Canadian Sulphur Ore Company. Other non-metallic minerals and products will include salt and products thereof, derived by the electric process, such as caustic soda and bleaching powder; barite, gypsum and talc, both crude and ground, corundum ores and abrasive products, feldspar in rock form and pulverized, fluorspar, clay products, including brick and fire clay, mica, peat etc., also samples of euxenite, a radio active mineral, from South Sherbrooke Township, and products of the distillation of hardwood, such as acetate of lime, acetone, wood alcohol, etc. This is probably the first time that a collection of the kind from Ontario has been made for public display. The development of the mineral industry is steadily advancing in the direction of more extended manipulation of raw material. The present war is exerting an important influence to this end, and further assistance is lent by the abundant supplies of electric power at low rate, particularly in the region adjacent to Niagara Falls, and at points on the Welland Canal. The presence of electric power is transforming these localities into important industrial centres, especially in the production of electro chemicals. Sulphur, limestone and salt are the raw materials for a whole series of important chemical products, and these Ontario has in great abundance. The progress of the metallurgical and chemical industries in this Province promises to be rapid and extensive. The Ontario collection will be under the direction of Mr. W. K. McNeill, Provincial Assayer, and Mr. W. R. Rogers, of the Bureau of Mines staff.

The Province of Quebec will be represented by literature distributed through the Department of the Interior if that department of the Federal Government has a booth. At the time of going to press this point had not been settled. Some interesting facts regarding Quebec mineral resources will be found in this issue.

The Shawinigan Water and Power Co. will have a large space in which will be shown a number of the electro chemical products, which have made that centre famous. Besides these samples leading industries will be shown by moving pictures. A sketch of the Shawinigan Falls industries appears elsewhere in this issue.

The Canadian Chemical Journal will be glad to welcome visitors at Booth No. 475.

SULPHUR

The Government has taken practical control of sulphur production and distribution in the United States.

At present the two principal sources of sulphur are at Calcasieu Parish, La., owned by the Union Sulphur Co., of New York, producing over 3,500 tons a day, and at Bryan Heights, Tex., owned by the Freeport Sulphur Co., also of New York, producing over 1,000 tons per day. Other properties in Wyoming, Nevada and Utah produce a little less than sixty tons per day. Present consumption in the United States is said to be about 125,000 tons a month, and this will be increased to 150,000 tons a month before the end of the year, due to increased Government use. Facts as reported indicate that there is danger of a serious sulphur shortage and that the mines are overworked. On May 22 the experts of the Bureau of Mines stated at a Senate hearing at Washington, that the country was facing a dangerous shortage. It was shown that the natural resources could not be depended upon to supply the country's needs, and that the most practical hope lay in the utilization of waste from the smelters. A. E. Wells, consulting engineer for the War Department, states that it is possible to develop a source of supply from the sulphur fumes, utilizing the thiogen reclaiming process, and that it would be possible to erect two plants of 500 tons a day capacity each to come into operation within a few months. Professors McKee and Hall, of Columbia University, concurred with Mr. Wells in the statement that there is little hope of the development of natural sulphur resources, and that artificial means, such as the thiogen process, will have to be resorted to.

The sulphur supplies of Sicily and Japan are unavailable, for both the Italian and the Japanese Governments have forbidden exportation from their respective countries.

Hawthorne Mills, Limited, Carleton Place, have commenced work on an extension to their woollen mills, to cost about $50,000. It will comprise an up-to-date dyeing and wool-scouring plant.

DR. J. BISHOP TINGLE

(By a Contributor.)

J. Bishop Tingle, B.A., Ph.D., F.C.S., F.R.C.S., Professor of Chemistry, McMaster University, Toronto, died on August 6th, at the residence of his brother in Ottawa, Ont.

The late Dr. Tingle was born in Yorkshire, England, and received his early education in the schools of that country. After studying under some well:known British scientists, he went to Munich, Germany, and obtained the degree of Doctor of

DR. J. BISHOP TINGE

Philosophy from the University of that city. His Inaugural Dissertation was filed in 1889; it dealt with the preparation of camphoroxalic acid and some of its properties. This was the first of a number of his brilliant researches on this and other organic compounds.

After leaving Germany he remained some time in England before coming to the United States.

He studied at University of Manchester under Sir H. E. Roscoe, and at Munich under Professors von Baeyer and L. Claisen. In 1890 he was appointed Assistant Professor of Chemistry at Bristol College, and in 1892 became Professor of Chemistry at Gordon's College, Aberdeen. From England he came to the United States in 1896, and for four years (1897-1901) was on the staff at Lewis Institute. From 1901-1904 he was Professor of Chemistry at Illinois College.

In the Fall of 1904 he was appointed to the staff of Johns Hopkins University, and remained there until the summer of 1907. This period was devoted largely to organic research and to editing sections of the American Chemical Journal.

In September, 1907 he accepted the professorship of McMaster University, reorganized the Department of chemistry, with much success and maintained it in a very high state of efficiency.

The late Dr. Tingle always worked energetically for the benefit of the students who came under his care. The thoroughness with which he taught, and the high standards of efficiency he set in the laboratory brought out the best qualities possessed by the student. He always encouraged the prospective chemist to take post graduate work, and if possible a Ph.D. course.

At the outbreak of hostilities in Europe he remarked to the writer that the chemist would play a vital part in the winning of the war. With this in view he organized special classes and gave extra lectures to students desirous of taking laboratory positions in war industries. In this way he contributed his share to the successful output of munitions in Canada.

It was his intention to go to Chicago this summer to prepare a new edition of his book on spectroscopic analysis, but death intervened, and left the work unfinished.

Recently Professor Tingle had been elected to the Fellowship of the Chemical Section of the Royal Society of Canada. Several weeks ago the Advisory Council of Scientific and Industrial Research paid tribute to his ability for research by voting him a sum of $1,200 to carry on a scientific investigation. For a time he was consulting editor of the Canadian Chemical Journal.

Dr. Tingle was 51 years of age. He is survived by his wife and two young children.

W. G. S.

TWO NEW LINES OF THOUGHT

By L. E. Westman, M.A., Ottawa.

Both to those men who have lived and worked long years under the old order of things chemical in this country, and to those younger men who have come on at the beginning of the new, the following quotation from the very recent Presidential Address of Prof. Henry Louis, now acting president of the Society of Chemical Industry, should bring encouragement, hope and satisfaction. We quote direct from the Journal of the Society of Chemical Industry.

"It so happens that the supreme crisis in which the nation now finds itself involved has caused us to revise our views on many subjects, and on none perhaps more completely than on the value of chemistry as a national asset. The nation has gone on for generation after generation, cheerfully committing its government to men whose training necessarily resulted in a complete ignorance of and almost a contempt for scientific methods. Fortunately we have always possessed a sufficient number of quiet, unobtrusive workers, whose devotion to science for its own sake has succeeded in maintaining the high standard of British science in spite of official neglect, and it is such men as these who have come to their country's assistance in its hour of need; had it been otherwise, our position would indeed have been hopeless. Under the spur of rude necessity, has come a sudden awakening, and even the most case-hardened parliamentarian has come to realize how entirely the nation is indebted for its very existence to the applications of science, and above all, chemistry; and many are at last beginning to recognize that this dependence is as complete in the industries of peace as in those of war. With this recognition has come a desperate rush in the attempt to make up for lost time, as though methods of scientific thought could be learnt in a day, and a century's neglect of scientific principles could be atoned for by the creation of miscellaneous committees. The realization of the vital need of the nation of a large body of thoroughly trained industrial chemists is at any rate all to the good, and it is a hopeful sign that the best methods of equipping such men for their life's work are attracting increasing attention. Fortunately the public interest thus aroused has enabled chemists themselves to attack these problems in a bolder manner than heretofore, under conditions that would have been impossible had they not felt that they are at last sure of a reasonable measure of public support."

This is the message and thus is the horizon broadened. Every Canadian chemist should seize on this viewpoint and apply it to himself and his work as much as his growing opportunity will allow. Everything you do to raise the value of your profession as a national asset will raise you. Look up for a moment from your immediate detail, realize yourself and what you stand for; look down again and perhaps the little thing you do may have attained a new significance.

Gradually we are being given glimpses of what has been done by those who staved off disaster during the earlier part of the war by holding what might be termed the front line trenches of industrial chemistry. Some of the most interesting and valuable work accomplished was carried out in England by Dr. Morris W. Travers, F.R.S., in connection with the manufacture of scientific glassware at a time when it was absolutely necessary that results should be immediately obtained. The work was done and it has

left the worker with a new idea or line of thought for his fellow chemists. We quote again from the same journal.

"A few days after the outbreak of war I met my friend, Mr. Douglas H. Baird, Chairman of Messrs. Baird & Tatlock (London), Ltd., who explained the position to me, laying particular stress upon the importance of chemical glassware in the steel industry, upon which a heavy strain was likely to be thrown, and upon the demand for glassware by the Army Medical Department and the hospitals. He told me that his firm were already considering the possibility of manufacturing scientific glassware upon a scale sufficient to carry them over the war, and were endeavoring to secure the co-operation of other dealers. He asked me if I would assist him, and I readily agreed, though I admitted that I had no wider experience of chemical technology than the average academic chemist. I may say that now, after spending almost the whole of my time during four years actually in the works, I approach the great problem of science and industry in a more humble spirit than may have possessed me when I was a professor of chemistry. I am inclined rather to blame academic chemists for the neglect of industry than the manufacturers for the neglect of science."

There was a time, not so many years ago, when that portion of the chemical profession, which held itself in highest esteem in America and in England scorned with a fine measure of contempt those lesser lights known as works chemists. The remuneration for practical work was even less than that attainable through academic effort. No matter what the causes were at the time, it remains that as a people we have suffered for this and have bought our experience dearly. But now the door has been opened somewhat; a revolution has started and is under way. The above quotations might easily be duplicated by accounts of work carried out in Canada and other countries. They are presented here simply as types of a change in thought following a change in effort. The academic chemist must function more and more as an industrial and business force if the momentum of this idea is to be carried on into the more normal times that are to come.

KALBFLEISCH CORPORATION'S EXHIBITS

The Kalbfleisch Corporation of New York, has rented spaces 555 and 556, for its exhibit at the Fourth National Exposition of Chemical Industries, in New York. The Corporation will exhibit samples of sulphuric, nitric and muriatic acids and aqua ammonia, which are of such interest at the present time, owing to the great demand by the Government for war purposes. Samples will also be displayed of the different grades of sulphate of alumina used for the purification of water, paper sizing, dry colors, etc., also samples of salt cake, used in the manufacture of glass and paper makers' sulphate, for Kraft Pulp. Owing to the great expansion in the manufacture of aniline colors in this country, the pure, anhydrous sulphate of soda, a specialty manufactured by The Kalbfleisch Corporation for the standardization of aniline colors, will merit unusual attention. So, also, will its exhibit of permanganate of soda, the manufacture of which has been perfected. This specialty is now widely used as a substitute for permanganate of potash.

B. C. MAGNESIUM SULPHATE DEPOSITS

Dr. D. McIntosh, of the University of British Columbia, recently exhibited at Ottawa some mineral specimens from British Columbia, including a block of massive magnesium sulphate from a bed carrying 50 to 60 thousand tons. He has also fine specimens of the crystals of this salt. Dr. McIntosh reports that there is in British Columbia a lake deposit of magnesium carbonate almost free from iron and lime.

The capital stock of Brunner Mond, Canada, Limited, has been increased from $3,000,000 to $5,000,000.

RECOVERY OF VAPORS FROM COAL GAS.

By Harold S. Davis, M.A., Ph.D. (Lecturer on Chemistry in University of Manitoba) and Mary Davidson Davis.*

Preface

(This bulletin embodies the main results of research carried out for two sessions, 1916-18, in the University of Manitoba, with some reference to practical tests carried out on the Light Oil Recovery Plant of the Toronto Chemical Co., at Sault Ste. Marie, Ont. The authors acknowledge the substantial grant given by the Advisory Council to aid the prosecution of this work during the session 1917-18. This grant was used to secure as a research assistant, Mr. Donald G. MacGregor, who has been intimately associated with the work. (Previous publications on this subject by same authors: "The Extraction of Aromatic Hydrocarbons from Gases, by means of Liquid Absorbents," University of Manitoba Publications, 1917; A New Method for the Estimation of Vapors in Gases," by Harold S. Davis and Mary Davidson Davis, J. Ind. & Eng. Chem. (in press); "The Application of the Differential Pressure Method to the Estimation of the Benzene and of the Total Light Oil Content of Gases," by Harold S. Davis, Mary D. Davis and Donald G. MacGregor, J. Ind. & Eng. Chem. (in press); Studies on the Absorption of Light Oils from Gases," by Harold S. Davis and Mary D. Davis, J. Ind. & Eng. Chem. (in press); "A Process for the Quantitative Estimation of Vapors in Gases," U.S.A. Patent allowed June 7th, 1918.)

Introduction

The number of problems arising from the tremendous impetus given the production of benzene and toluene since the year 1914, led to the investigations outlined in the papers.

Benzene is a colorless liquid boiling at about 80 deg. and freezing at about 5.5 deg., with a specific gravity of 0.87. On account of its theoretical and practical importance, it holds a place almost unique among organic compounds. It is the basic substance from which the greater part of organic compounds constituting what is known as the aromatic series, may be considered to be derived. Many of these compounds such as phenol and aniline are actually synthesized from it on a commercial scale, while great quantities are used in the manufacture of high explosives. It makes an excellent motor fuel, particularly when certain suitable organic liquids are dissolved in it, lowering its freezing point and also preventing the deposition of carbon in the cylinders. Commercial fuels such as "bengas" are formed in this way.

Toluene is also a liquid, of a somewhat higher boiling point and lower freezing point than benzene. It is used in large quantities in the manufacture of the high explosive, trinitrotoluene.

The increase in the number of industries concerned with the manufacture of these substances since the beginning of the war has led to an over-production of benzene in America; the supply of toluene, however, is still quite inadequate.

These two substances, benzene and toluene, are mainly obtained as by-products from the destructive distillation of coal.

The Destructive Distillation of Coal

When coal is heated in a closed space with the exclusion of air, it undergoes decomposition and a great many chemical substances are formed. At ordinary temperature some of these are solids, others liquids, and many gases. A great deal of solid material remains in the oven, and constitutes *coke.* The mixture of other substances formed in great volume is drawn off from the coke ovens. The greater part of this gas mixture is composed of such permanent gases as methane and carbon monoxide, but it also contains small quantities of a large number of liquids and solids of various boiling points. As it is cooled, partial condensation takes place, and one or more complex solutions appear. At ordinary temperatures, at least two solutions separate out, one composed largely of water, known as *ammoniacal liquor.* the other made up of a great number of organic substances and known by the general name, *tar.*

It would be a fundamental mistake, however, to suppose that some substances completely condense into the solution while

others pass along in the gas. Rather, each substance distributes itself in a certain ratio between the gaseous and liquid phases.

About 1 to 2 per cent. by volume of the gases from the coke ovens is composed of compounds of the aromatic series, chiefly the hydrocarbons, such as benzene and toluene. They are the chief constituents of what is technically called the "light oil."

Of course a certain amount of these substances stays in the tar, especially if it is separated from the gas at a low temperature; indeed, for many years tar was their chief source. But by far the greater quantity of the light oils remains in the coal gas, even after it has been washed with water or otherwise purified. The ratio of the amounts in the gas and in the tar is 20—40: 1.

The amount of each of these vapors in the gas is far below its saturation concentration, i.e., the concentration in equilibrium with the pure solid or liquid substance at that temperature. To separate these vapors from the gas, two main methods have been employed:

1. The gas is cooled and compressed so that the concentration of the vapors is brought above saturation and they separate out as liquids.

2. The vapors are absorbed into a high boiling oil, from which they are subsequently separated by distillation.

The first method has never been a success commercially; the latter is the one universally employed.

The Recovery of " Light Oils " from Coal Gas.

The theory of the washing process may perhaps be more readily understood if we consider the extraction of one vapor only, e.g., benzene, from a mixture of permanent gases.

Consider a bubble of gas at a definite pressure and temperature, surrounded by a pure washing liquid. The benzene vapor in the gas will dissolve in the oil until the vapor pressure of benzene from the surrounding oil is equal to that in the gas. So the maximum content of benzene which can be absorbed by the oil from the gas is that which gives a vapor pressure of benzene from the solution equal to the vapor pressure of benzene in the gas. Consider a counter-current washing system for washing the gas continually with oil. The gas passing from A to B meets the oil travelling in the opposite direction. At B fresh oil takes out the last traces of benzene from the gas, since such oil has no vapor pressure of benzene. The oil thereby acquires a vapor pressure of benzene proportional to its benzene content, and in passing from B to A, it continuously meets gas with a higher vapor pressure of benzene until at A it could leave with a vapor pressure of benzene equal to that in the gas entering at A. The benzene is separated by distillation from the oil and the pure oil re-enters the absorption column.

To ensure complete removal of the benzene from the gas there are two necessary conditions:—

1. The contact between gas and oil in the space A to B must be sufficiently good to nearly maintain equilibrium at every point.

2. The rate of flow of the oil must be so regulated that the quantity of benzene carried from the washers per second shall be equal to the quantity brought in by the gas.

Several important points should be noted here:

1. If just that amount of oil is passed through the washers, which is necessary to completely remove all the benzene from the gas, the vapor pressure of benzene from the oil emerging from the scrubbers (technically the "rich oil") will be equal to that in the rich gas, and all the benzene will have been washed from the poor gas. If less oil than necessary is passed through the washers, the rich oil will be saturated as in the first case. Some of the benzene, however, will pass through in the poor gas, since there is not sufficient oil to remove it. Finally, if more oil than necessary is used, all the benzene will be removed from the poor gas, but the vapor pressure from the rich oil will never be equal to that in the rich gas.

2. If it is desired to completely remove all the benzene from the gas, the flow of oil should be somewhat greater than the amount theoretically necessary, so that the vapor pressure of benzene in the gas will always be greater than its vapor pressure from the oil. This gradient of vapor pressure will tend to dissolve the benzene from the gas into the oil. The nearer perfect the washing system the smaller this gradient need be. On the other hand a very inefficient washing system will extract all the benzene if sufficient oil is passed through the scrubbers. However, since the chief cost in benzene recovery is concerned with the separation of the benzene from the rich oil, it is desirable to use as little washing oil as possible.

3. In order to completely remove the benzene from the gas, the poor oil which enters the scrubbers must be completely free from benzene, *for no amount of washing will ever lower the vapor pressure in the poor gas below that of the poor oil with which it is finally washed.* The pressure of benzene in the poor oil means that the steam distilllation is inefficient, and does not completely separate the benzene from the washing oil. Such inefficiency may cause a very serious loss to the plant, for the fraction of benzene lost will be the ratio of the vapor pressure of benzene from the poor oil to that in the rich gas. Later in this paper, methods of measuring this ratio will be described.

The Relation Between Maximum Enrichment and the Composition of the Oil

From what has preceded it will be plain that the maximum enrichment of benzene which the oil can assume is the quantity which will give a vapor pressure of benzene equal to the vapor pressure in the gas. Hence the maximum enrichment will depend upon the content of the gas and the pressure upon it. In order to determine the other factors governing this maximum enrichment, we carried out a series of experiments in which we measured the vapor pressure of benzene from solutions in washing oil, using different concentrations and different temperatures. The results obtained may be summarized as follows:—

1. The vapor pressure of benzene at 33.2 deg. from two solutions in oil, one of approximately double the concentration of the other, was directly proportional to the concentration. That is to say, the vapor pressure of benzene from a solution in oil, and the concentration of benzene in the oil are related according to Henry's Law for the solubility of gases in liquids—a result of great theoretical and practical importance.

2. The ratio of the vapor pressure of benzene from a solution of definite concentration to its saturation pressure was independent of the temperature. (Von Babo's Law.)

It is thus possible to calculate the vapor pressure of benzene from a solution of any particular concentration at any temperature, since the vapor pressure of pure benzene is known at that temperature and also the ratio borne to it by the vapor pressure from a 1 per cent. solution in oil.

The amount of fresh washing oil required for any particular rate of flow of gas depends only on the temperature of washing. The benzene content of the gas does not affect it; for if this content is increased, then the maximum content in the rich oil is increased in the same proportion.

Now the efficiency of an oil for absorbing benzene from gases is determined by the magnitude of the vapor pressure of benzene from its solution in the oil, or to look at it from another point of view, the efficiency of an oil is determined by its power to lower the vapor pressure of benzene when dissolved in it. For dilute solutions in common solvents, this power of lowering the vapor pressure is inversely proportional to the molecular weight of the dissolved substance, so that if the molecular concentration of the solution is known, the proportionl lowering of the vapor pressure of the solvent can be calculated from a well known formula. Since benzene and the washing oil used were soluble in all proportions we suspected that this relation might hold for very concentrated solutions; results confirmed this supposition.

The average molecular weight of the oil determined by the

freezing point method was found to be 205. From this, the vapor pressure from a 99 per cent. solution of oil in benzene, i.e., a 1 per cent. solution of benzene in oil, was calculated to be .0263, in excellent agreement with the experimental result .026.

The determination of the molecular weight of an oil when dissolved in benzene seems therefore to afford a good method for testing the efficiency of the oil for absorbing benzene or other vapors from gases; the lower the molecular weight, the greater the efficiency.

A few tests were made on absorbing oils used at a light oil recovery plant, in order to ascertain if this method of standardization would hold. In general it was found that oils of low molecular weight, 200-230, were good absorbers in practice, while an oil with a much higher molecular weight, 280, had been rejected as inefficient. It is hoped that research may lead to the development of washing media with lower molecular weights than those of the present absorbers, which at the same time will have the desired qualities of fluidity, boiling point, etc.

So far we have considered the removal of one vapor only from the gas. Similar considerations apply to the removal of a mixture of vapors such as those which make up the "light oils."

In considering the process of absorption of light oils into washing oil, account must be taken of the following premises, experimental confirmation of which is cited further on in the paper:

1. Each separate vapor contained in the gas dissolves in the washing oil, independently of the other vapors present, until equilibrium is reached between its vapor pressure in the gas and its vapor pressure from the oil solution.

2. When washing of moderate efficiency is employed, equilibrium between the oil and each of the light oil vapors is reached much more quickly than has often been supposed.

Of course each of the constituents of the gas, other than the light oils, also dissolves in the washing medium until corresponding equilibrium is reached, but the amount dissolved is so small that their effect may be neglected.

Now although the oil constantly absorbs vapors from the gas, equilibrium between the vapor pressures of each substance in the gas and from the oil being closely maintained at every stage, it does not follow that the oil becomes saturated with every vapor at the same stage of washing. Rather, the stage at which the oil becomes saturated with respect to any one vapor is determined by the saturation pressure of the pure liquid of the same composition as the vapor in question.

Consider now the absorption of benzene and toluene vapors from the gas into the washing oil. The benzene content in the rich oil will be at its maximum when it gives a vapor pressure of benzene equal to that in the rich gas. At this stage the dissolved toluene only gives a pressure from the oil equal to a fraction of the toluene pressure in the rich gas. This fraction can be shown to be equal to the ratio of the saturation pressure of pure toluene to that of pure benzene, so that when the oil is saturated with benzene it is only 3/10 saturated with toluene. Any attempt to obtain a higher percentage of toluene in the rich oil, will result in loss of benzene, for some will now pass through unabsorbed.

If by the maximum enrichment of the washing oil is meant the maximum quantity of light oil which it can contain, without any light oil passing through unabsorbed, then it is reached when the vapor pressure from the washing medium of the lowest boiling compound in the light oil, in this case benzene, is equal to its pressure in the rich gas.

From the equation for the lowering of the vapor pressure, referred to above, using an oil with an average molecular weight 205, the following calculations can be made for a gas with a vapor pressure of benzene of .6 cm. and of toluene of .15 cm.

1. The possible concentration in oil at 26 degrees for benzene is 2.3 per cent. and for toluene 2.3 per cent.

2. When the oil is saturated with benzene, it will have taken up only .68 per cent. of toluene. (Concluded in next issue)

AN AGRICULTURAL SOURCE OF BENZOIC ACID

By P. J. Moloney, M.A., and Frank T. Shutt, D.Sc., Ottawa

(Summary of a Paper Before the Royal Society of Canada.)

The two chief sources of the benzoic acid of commerce are (1) toluene and (2) gum benzoin; from the first is manufactured, by oxidation, practically all the benzoic acid used in the coal-tar industry and from the second is obtained, by sublimation, that employed in pharmacy and as a food preservative.

The price of benzoic acid is five or six times higher than it was previous to the war, and the thought occurred to one of the writers that it might be possible to find a cheaper source in the urine of the herbivorae, provided one or other of the methods that have been proposed, and to some extent used, could be so simplified that the first stages could be conducted on the farm, without any special apparatus.

Scheele obtained benzoic acid from cow's urine in 1785, Liebig, in 1829, demonstrating that it was not present as such in the urine, but was formed by the decomposition of hippuric acid. The fact, therefore, that benzoic acid could be obtained from the urine of the herbivorae has been known for more than a century, but the fact has been one of scientific interest rather than commercial importance.*

Benzoic acid has been prepared from urine by three methods: (1) the urine is allowed to putrefy in order to induce the hydrolytic decomposition of the hippuric acid into benzoic acid and glycocoll, according to the equation—

$$CH_2\left\langle\begin{matrix}NHC_7H_5O\\COOH\end{matrix}\right. + H_2O = CH_2\left\langle\begin{matrix}NH_2\\COOH\end{matrix}\right. + C_6H_5COOH$$

Milk of lime is then added, the solution filtered and the benzoic acid, after concentration of the filtrate by evaporation, precipitated with strong hydrochloric acid.

(2) The putrified urine after addition of milk of lime is treated with CO_2. This removes the excess of lime. Ferric chloride is now added, and the insoluble ferric benzoate after filtration is decomposed by hydrochloric acid.

(3) The fresh urine is evaporated to about one-third its original volume, filtered, acidified with hydrochloric acid and allowed to cool. Hippuric acid crystallizes out and may be hydrolyzed to benzoic acid and glycocoll by boiling with concentrated hydrochloric acid or sodium hydrate.

All three methods present certain difficulties, especially when considered as processes for use on the farm. Methods (1) and (3) involve expensive and disagreeable evaporation and (2) requires the necessary apparatus for the preparation of carbonic acid gas, and includes the troublesome filtration of a fine, voluminous precipitate.

From a consideration of the change of solubility of benzoic acid with the temperature, the possibility suggested itself of separating benzoic acid from putrefied urine and also hippuric acid from fresh urine by precipitation at low temperatures.

Solubility of Benzoic Acid in Water

Temperature Centigrade	Benzoic acid per 100 grams solution Grams
0	0.170
10	0.209
20	0.289
25	0.343

From these data it may be shown that by cooling a solution of benzoic acid to 0° C. an amount of acid will separate out equivalent to an amount obtained by concentration of the solution to one-half its volume and cooling to 25° C.** Thus, from a solution of benzoic acid containing .5 grams per 100 cc.; .330 grams will separate out on cooling to 0° C., leaving in solution .170 grams. The same solution (.5 gram per 100 cc.) concentrated to one half its volume, i.e., 50 cc., precipitates .329 grams on cooling to 25° C., leaving in solution .171 grams.

No table of solubilities for hippuric acid could be found, but conjecturing that its curve of solubility would approximately parallel that of benzoic acid, the work about to be described in this paper was undertaken; the method used for determining the benzoic content, i.e., the total amount of benzoic acid after hydrolization of the hippuric acid of the urine in the several experiments, being that of Steenbock.* * * (J. Biol. Chem. XI, 204, 1912.)

Benzoic Acid from Cow's Urine

1. 100 cc. fresh urine, total	0.64 gram
2. 100 cc. fresh urine evaporated to one-half original volume, acidified with HCl and cooled to room temperature and the benzoic acid content determined in the precipitated hippuric acid	0.35 "
3. 100 cc. fresh urine, acidified with HCl, cooled to 0°C. and the benzoic acid determined in the precipitated hippuric acid	0.35 "

From these results it will be seen that a method for obtaining benzoic acid from urine by cooling the fresh acidified urine to 0°C. is as efficient as evaporating the fresh, urine to one half its original volume and precipitating the hippuric acid at room temperature.

Using the above data as a basis of calculation and assuming 20 pounds of urine daily per 1,000 pounds weight of cow, the total daily benzoic acid output would approximately be 1 pound per 8 cows. By acidifying and cooling to 0°C., as described above and assuming that all the urine is collected, the amount of benzoic acid available daily, would be approximately 1 pound per 15 cows.

In the case of putrified urine, i.e., urine in which the hippuric acid had hydrolized by the bacterial action to benzoic acid and glycocoll, it was found that very little benzoic acid separated out after acidification and cooling to 0°C. However, if the putrefied urine is first clarified with milk of lime, allowed to stand until clear and the supernatant liquid poured or siphoned off, the benzoic acid readily separates out on acidification and cooling, the percentage of efficiency being practically that obtained in working on fresh urine.

On account of the possibly greater value of the products, hippuric acid, benzoic acid and glycocoll, it would seen desirable to use fresh urine, but so far it has not been determined if this would be generally possible under ordinary stable conditions.

In this simple method of acidification and cooling to 0°C. it would appear that we have the basis of an economic process for the production of benzoic acid from urine which might be employed over a large part of the Dominion during the winter months. The modern cow barn with its concrete gutter, would much facilitate the collection of the urine and where twenty-five or more head of stock are housed in the same building, as is now frequently the case on dairy farms, there would seem to be the possibility of making the preparation of this by-product a profitable adjunct to the dairy business.

*Benzoic acid from this source has been characterized by a slight smell of urine, "removed or concealed by mixing the acid with a small quantity of gum benzoin and subliming it."

**To avoid loss of benzoic acid by volatilization during evaporation it would be necessary to first convert into the sodium salt by addition of caustic soda.

***100 cc. fresh urine is boiled with 10 grams NaOH for 2 hours under a reflux condenser in order to hydrolize the hippuric acid to benzoic and then acidified with 50 per cent. H_2SO_4. Bromine water is then added to precipitate phenols—and the solution cooled and made up to 250 cc. A 50 cc. aliquot is extracted with four portions—50 cc.—40 cc.—20 cc.—20 cc. of sulphuric ether. The combined ether solution is slowly dropped into a U-tube through which a current of air is drawn, the U-tube being kept in a water bath which is kept at a temperature of 40°C.

The benzoic acid is then sublimed from the U-tube into a tared condensing tube—the condensing tube consisting of a glass tube 25 cm. long, 9 mm. bore, 25 grams in weight, with three glass bulbs blown on it, the bulbs being filled with glass wool.

The sublimation was carried out at a temperature below 130°C.

A permit has been issued to the British Forgings Company, Limited, to erect a heat drying building on Commissioner Street, Toronto, at a cost of $12,000.

NOTES FROM NEW YORK

(Correspondence of the Canadian Chemical Journal, by F. M. Turner, Jr.)

New York, Sept. 12, 1918.

The Bayer Company, Inc., of New York, manufacturers of dyestuffs, pharmaceutical chemicals, etc., with works at Rensselaer, N.Y., is the subject of a government investigation. Five of the officials of the company, H. C. A. Seebohm, Dr. R. J. Pabst, A. Reiser, Dr. Albert Segin and Dr. R. Hutz, have been placed under arrest, charged with conspiracy to divert the earnings of the company into enemy hands after placing it under the control of the Alien Property Custodian. The earnings of the Bayer Company, prior to its assumption by the Alien Property Custodian, were in the neighborhood of $1,500,000 per annum. The company voluntarily turned its affairs over to the Alien Property Custodian early in the year. Recent investigations by the Department of Justice showed that an arrangement had been secretly made with a firm known as the Williams & Crowell Color Co., Providence, R.I., to turn over to them a large percentage of the earnings of the Bayer Co. This company has been found to be a subsidiary of the Bayer Co. Seebohn, secretary of the Bayer Co., was informed, after all the evidence had been collected by the Government, that he had either misappropriated the funds of the stockholders by taking the money he had used for this purpose without authorization, or else he had conspired with his associates to surreptitiously evade the Trading with the Enemy Act. Confronted with this dilemma, Seebohm admitted the connection with the Providence concern, and produced minutes of a meeting of the directors, showing that the Bayer Company's directors had authorized getting control of the Providence concern. The Bayer Co. is a branch of the great Bayer Co. of Germany. The American firm has been concerned in several attempts, since the outbreak of war in 1914, to further the interests of the agents of German dye firms in America. It is understood that the money the company attempted to divert from the Alien Property Custodian was to be used to re-establish German chemical interests here after the war, for which purpose a site had already been purchased on the New Jersey waterfront in New York Harbor.

The plant of the Stauffer Chemical Company, Chauncey, N.Y., makers of carbon bisulphide, was damaged by fire recently. The fire was caused by leaky pipes, the bisulphide fumes becoming ignited from the furnaces. The repairs are being undertaken immediately, but owing to difficulty of securing building materials, some delay may be experienced. In the meantime the two branch plants of the company will take care of production.

The Sinclair Gulf Refining Company is erecting an oil refinery at Houston, Tex., with a capacity of 20,000 barrels of oil per day. As soon as this refinery is completed, a second one on the same site, will be begun, to take care of an equal capacity. This refinery will utilize oil from the Mid-Continent region and also will secure oil from Mexico.

The Appellate Division of the Supreme Court, New York, has decided that the use of saccharin for sweetening purposes in soft drinks is to be permitted. The ruling is based on the arguments that saccharin in such proportions (1/100 of 1 per cent.) is perfectly harmless; that it could only be objected to on the grounds that the purchaser was not obtaining the food value of the sugar, and that people do not purchase soft drinks for their food value; that the fact of the drink being sweetened with saccharin is clearly stated on the label; and that many persons may specifically desire a drink free from sugar. There has recently been great interest taken in the manufacture of saccharin, several new companies having undertaken its manufacture.

The Government has appointed Mr. James A. Branegan, of the staff of the General Chemical Company, to be Vice-President of the Heyden Chemical Co., Garfield, N.J., recently seized by the Alien Property Custodian. Mr. Branegan is well known as a chemist, inventor and writer on technical subjects. During

the period that Mr. Branegan has been chairman of the Membership Committee of the Philadelphia Section of the American Chemical Society, the membership has about doubled.

A cyclone hit the plant of the Union Sulphur Company, Lake Charles, La., and did considerable damage, blowing down all the derricks and damaging other parts of the plant. According to company officials, 90 per cent. of all the buildings were ruined. The Union Sulphur Company is the largest sulphur producing firm in America. It produces over 4,000 tons of sulphur daily. It supplies numerous firms making explosives and sulphuric acid. Fortunately a reserve of 1,500,000 tons was maintained pending just such an emergency, and the plant will be repaired immediately.

The American Cellulose and Chemical Company is building a plant at Cumberland, Md., costing $15,000,000 to produce cellulose acetate products, used primarily for aeroplane wings. This concern is associated with the British Cellulose Company, whose works are at Derby, Eng. This firm is under investigation by the British Government on account of charges that public officials were benefitting by a monopoly. Two Canadians, Sir Sam Hughes and Col. Grant Morden, are interested in the British firm. The British plant employs over 10,000 hands.

Mr. Adrian Nagelvoort, formerly one of the managers of the National Exposition of Chemical Industries, New York, and who took out a commission in the Ordnance Corps when the U. S. entered the war, has recently been promoted to be a Major. At the present time Major Nagelvoort is in charge of the important chemical work of the Chemical Warfare Division at Niagara Falls, N.Y.

In the July issue we alluded to the American Chemical Society as having approximately 8,000 members. The Secretary, Dr. Chas. L. Parsons, informs us that the membership is now well over 12,000 and is increasing all the time. It is a pleasure to make this correction.

Mr. Donald R. Staddon, of Donald R. Staddon & Co., industrial chemists, of this city, has entered the government service for the duration of the war, and is at present at Niagara Falls, Ont., at the plant of the American Cyanamid Company. During his absence the business is being run by Mr. John Helfrich, who is well known as a chemist in New York. Mr. Edward Uhl has also associated himself with this company as consulting mechanical engineer, and will give particular attention to the mechanical engineering problems of the chemical industries.

The War Industries Board has taken over the production of chlorine, selecting Mr. H. G. Carrell, of the Solvay Process Company as the man in charge of allocating the product. Mr. Carrell is well known among chemists and those connected with the commercial side of the chemical industry. He has recently been in charge of the publicity activities of the Solvay Company, and is largely responsible for the attractive exhibit of their products at the Chemical Exposition last year. Mr. Carrell has been twenty-one years in the alkali business as chemist, chemical engineer, sales manager, executive, etc. For some months he has been a "dollar a year man" at Washington. He is a graduate of Cornell University.

This action by the War Industries Board, following quickly similar action in regard to control of sulphur-bearing materials, indicates the policy of the War Industries Board to take over one at a time the essential war chemicals when threatened shortage or any disturbing element in the trade endangers an adequate supply for war purposes.

All chemists in the military service are to be detached from the units with which they are now assigned, and all efforts concentrated and co-ordinated under the new chemical section. Newly drafted chemists will be assigned to this organization, and the section has been given authority to assign enlisted or commissioned chemists to establishments manufacturing for the Government.

How all the chemical work that has heretofore been carried on under various branches of the military service, such as the medical and ordnance departments and the Bureau of Mines of the Interior Department, have been centralized and co-ordinated into the one chemical section, is told in an official statement, authorized by the War Department.

Henceforth all phases of gas warfare will be under the control of the Chemical Warfare Service, commanded by Major-General William L. Sibert. Heretofore chemical warfare has been carried on by divisions in the Medical Department, the Ordnance Department, and the Bureau of Mines. All officers and men who have been connected with offensive or defensive gas warfare here will be responsible to the Chemical Warfare Service. The field training section at present is under the Corps of Engineers. Defensive warfare has been under the control of the Medical Department. This work has consisted of the designing and manufacture of masks. The control of the chlorine products will be exercised differently, however, from the control of the sulphur-bearing materials where the Chemical Alliance is being used as a medium for dealing with those in the industry.

Continuing and increasing demands for chlorine, an essential component for gas-filled shells and the principal ingredient of carbon tetrachloride, which is greatly in demand for smoke-screen purposes and for fire-extinguisher purposes, has caused the governmental action.. As chlorine gas is now being used with more deadly effect than the noxious mustard gas of the Germans, the War Industries Board's action may be taken as indicative of preparations for more vigorous prosecution of the gas warfare against the Germans. The recent transfer of all gas warfare work from the United States Bureau of Mines to the War Department seems to confirm a belief that a great gas offensive drive is soon to be started.

The fact that chlorine is so important in gas warfare, and the necessity of preserving secrecy regarding gas warfare plans, makes it impossible for the reporter to give more detailed information regarding the plans of the War Industries Board at this time. The assurance can be given, however, that while nothing will be allowed to interfere with the war requirements, great care will be exericsed to interfere as little as possible with the trade requirements. The trade is advised on good authority that whatever sacrifices may be asked should be given as a patriotic duty, and that every care in conservation now will be a direct aid in winning the war.

One of the most important commercial uses of chlorine is in the bleaching of paper and various cloth fabrics.

This is the first product that the alkali and chlorine section of the War Industries Board has commandeered. This section, of which Mr. Carrell is chief, also handles caustic soda, soda ash and lime, and potash for military requirements.

The firm of Roessler & Hasslacher, 100 William St., New York, who for many years have occupied a prominent place in chemical industry in this country, and who control the Niagara Falls Electro-Chemical Co., and the Perth Amboy Chemical Co., is under investigation by J. L. Becker, Deputy Attorney-General of New York State. The parent company of the group is the Gold u. Silber Scheide Anstalt, Frankfurt, Germany. A transfer of stock, with a view to frustrating the taking over of the concern by the Alien Property Custodian is alleged to have taken place. The concern is very prosperous and has been one of the leading sources of supply of cyanide, chloroform, formaldehyde and other chemicals. In 1916 the Roessler & Hasslacher Co. paid dividends of 50 per cent., the Niagara Co. 1,100 per cent., and the Perth Amboy Co. 100 per cent.

The City of Newark has compelled the Butterworth-Judson Company to cease allowing fumes from the manufacture of picric acid to escape from their plant on the Hackensack meadows. This is the largest plant in the country which supplies picric acid to the Government. The company has planned an installation to prevent the escape of these fumes, but freight congestion has delayed the arrival of the equipment.

CANADA AND ELECTRO CHEMISTRY

By Francis A. J. FitzGerald, Mem. A.I.E.E., Niagara Falls

I.—Electro chemical Industries

In an interesting article on "Applications of Science to Warfare in France," appearing in The Scientific Monthly of October, 1917, Dr. George K. Burgess says:

"In conclusion, I am tempted to quote the scientific definition of this war as given by a distinguished Belgian officer in the French service. The early incursions of the Germans were for the visible supplies of potential energy above the ground—the cereals; the present war is their attempt to gain control of the sources of invisible potential energy below the ground—coal and iron; and the next may be caused by their thirst for the sources of kinetic energy—the waterfalls."

H. Louis in *Nature*, of November 29th, reviewed an important article which appeared in the November Fortnightly Review, under the title "Coal and Iron in the War—The Importance of Alsace and Lorraine," and which presents strong evidence in support of the definition of the war quoted by Dr. Burgess. This evidence is based on a memorandum, dated May 20, 1915, presented by six important agricultural and industrial societies in Germany to the Chancellor. The document sets forth the demands of these societies in relation to the terms of peace, and among these we find one asking that Germany retain possession of the French coast as far as the Somme, because "by the acquisition of the lime of Meuse and of the French coast, the iron-producing district of Briey as well as the coal-fields of the north end of the Pas de Calais, would be acquired."

There is, in Central Europe, a vast deposit of iron ore known as "Minette" and there can be little doubt that the desire to gain control of these Minette iron-ore deposits was at least a strong contributory cause of the Great War. That the Germans fully appreciated the ore deposits is shown by an article in *Stahl und Eisen* in 1911. It appears that the amount of ore available is as follows:

French Lorraine	3100	million tons
German Lorraine	1841	" "
Luxemburg	250	" "
Total	5191	" "

But besides the much greater quantity of coal in France, the French coal is of superior quality and the Germans feared that this would give the French a distinct advantage over them. Thus there was good reason for the cupidity of the German iron and steel manufacturers and their desire to force a war which would permit them to plunder France and give them the monopoly of iron ore in Europe. Only the other day the daily papers published translations of confidential German documents showing the enormous importance that they attach to the plundering of the French coal and iron mines not only for the immediate future of German industry but for the prosecution of the next war to which they already look forward.

But in this later war can it be doubted that one of its primary objects will be to secure the kinetic energy of the waterfalls? The Germans already fully realize the importance of this energy. They long ago realized the serious nature of the nitrogen problem and the relation of that problem to the availability of enormous quantities of cheap electrical energy. It was this that led Germany to obtain a controlling interest in the great supply of hydro-electric energy in Norway and to encourage in every way the development of processes for the fixation of nitrogen like the manufacture of cyanamide. Germany also realized the importance of hydro-electric energy in the development of numbers of electro-chemical and electro-metallurgical industries which have so greatly increased in recent years and the products of which have become vital necessities in nearly all other industries and in the daily life of everyone. It is unquestionable that her relatively poor supply of the kinetic energy of waterfalls is a serious handicap in the present war.

One of Canada's greatest resources is her waterfalls, and a fuller realization of the importance of these is one of the benefits that will result from the Great War. The most largely developed of Canada's resources in the kinetic energy of waterfalls is found in Niagara Falls, but it needed the demands of the war to bring about anything approaching a true appreciation of the importance of this hydro-electric development and its proper place in the life of the nation. Consider for a moment a partial list of products which can be best and most economically manufactured by hydro-electric energy:

Aluminum	Carborundum	Silicon
Magnesium	Caustic soda	Phosphorus
Carbon electrode	Sodium chlorate	Alundum
Ferro-titanium	Chlorine	Caustic potash
Ferro-chromium	Cyanamid	Potassium chlorate
Ferro-vanadium	Ferrosilicon	Calcium carbide
Carbon-bisulphide	Ferro-molybdenum	Graphite
Sodium	Ferro-tungsten	Electrolytic Zinc

It would take a volume to consider all these products in detail pointing out in some cases their relative and in others their absolute dependence on hydro-electric energy; but brief consideration of some of them more especially in their relation to a state of war will be of value.

Aluminum is probably the largest consumer of energy in the electro-chemical field. The metal is of essential importance in the construction of aeroplanes, motors, the equipment of the soldier in the field, etc. The amount of energy required per pound of aluminum is so large that the cost of the energy is one of the largest items making up the total cost of production.

Until the advent of the electric furnace we were altogether dependent on natural substances such as corundum, emery, etc., for abrasive purposes. The invention of the artificial abrasives, carborundum and alundum has completely revolutionised a large part of the methods of metal working. Moreover, the artificial abrasive apparently is steadily conquering the abrasive field; until, according to Tone in 1914, 62 per cent. of all the abrasives used is the electric furnace product. These abrasives are used in the manufacture of nearly all articles into which metals enter, and their enormous superiority for most purposes to the natural products makes them essential articles in modern life.

The importance of the ferro-alloys which can only be manufactured in the electric furnace is enormous. Practically every pound of steel manufactured absolutely requires the use of ferro-silicon and while a low grade of ferro-silicon containing about 12 per cent. silicon can be made in the blast furnace it would be calamitous if the supply of the high grade, 50 per cent. and 75 per cent. ferro-silicons which can only be made in the electric furnace, were cut off.

The other ferro alloys, ferro-chromium, ferro-tungsten, ferro-molybdenum, etc., are not only essentials in everyday existence, but it must be remembered that in a state of war we could not build our battleships, our submarines, our torpedoes, our armor-piercing projectiles as we do, without these electric furnace products.

All of the electric furnace products we have considered are dependent on the carbon electrodes which in their turn demand the product of electric furnaces for their manufacture, and when we come to the consideration of electro chemical processes the paramount importance of another electric furnace product, graphite electrodes, is at once apparent.

Before the Great War started its originators had developed to a considerable degree of perfection the new weapon, poisonous gas, which promised to be of great value since their civilized enemies would neither have such a weapon themselves nor be prepared with a defence. Fortunately the use of gas was something in the nature of an experiment, so that the Germans were not prepared to use it on such a large scale as to produce the disastrous results which might have been obtained had its effectiveness been

fully realized. Now, the Germans are attempting through the Red Cross to renew the agreement which they broke, and eliminate the use of poisonous gases, because they find that their opponents are obtaining a superiority in this weapon. While a great variety of poisonous gases are used, probably that most largely employed is chlorine or chlorine derivatives, important electro-chemical products, depending too on the use of graphitised electrodes. But quite apart from this exceptional use of chlorine its value in peaceful life is very great as the most valuable of sterilising agents in the treatment of water supplies and the consequent elimination of typhoid epidemics; as a bleaching agent for paper, cotton, linen, etc.; for the manufacture of chloroform, of carbon tetrachloride, of "intermediates" in the making of coal tar dyes by combination with bezol and toluol.

In making chlorine by electrolysis of salt solution, caustic soda is also produced, and besides the innumerable uses of this substance in our daily life, it forms the raw material of another important electro-chemical industry—the manufacture of sodium.

If the industries of the country, as they exist to-day, are studied, it will be found that there is hardly one which does not depend to a greater or less extent on products of electro-chemical manufacture and since all that we use in our daily life is dependent on industry, it may truly be said that this life is closely related to electro-chemical activities. In consequence of this, anything affecting electro-chemical industry is of vital importance to all of us.

Now a characteristic of nearly all electro-chemical products is that for their manufacture an abundant supply of electric energy must be available at a low cost only attainable by means of hydro-electric generation. Therefore a country like Canada, than which no other is more richly endowed with water power, is bound in the future to be one of the great electro-chemical countries of the world, and there is no problem of greater importance or more worthy of close study than that of the proper use of its water power resources.

(The next article by Mr. FitzGerald will deal with the problem of electric energy from water power in comparison with steam.)

LAPSED CANADIAN PATENTS

Reported by Hanbury A. Budden, 712 Drummond Building, Montreal, Que.

The following patents lapsed June, 1918, for non-payment of renewal fees:

140,849. Cement, Cornwell, U.S. Plaster composition containing a large proportion of hydrated lime mixed with fused calcium aluminate and sodium bisulphate.

140,927. Pump, Humphrey, England. Method of pumping by combustible discharge acting directly on liquid.

140,933. Method of producing low temperatures, Lachmann, Germany. Compressing mixture of ethylene and propane cooling by natural means to liquify and evaporating to produce low temperatures.

140,935. Method of producing low temperatures, Lachmann, Germany. Compressing ethane gas, cooling by natural means, evaporating under atmospheric pressure and transmitting cold produced to oxygen under pressure.

140,934. Method of Producing low temperatures, Lachmann, Germany. Compressing methyl-fluoride, cooling by natural means, and evaporating under vacuum pressure.

141,000. Adhesive, Isaacs, U.S. Dextrine and soluble elements of sea-weed.

141,002. Leather waterproofing process, Johnston, N.S.W. Degreasing leather, removing the grain side, saturating in varnish and drying.

141,015. Fertilizer, Masserschmitt, Germany. Decomposing silicates containing alkalis with calcium compounds, separating alkalis by lixiviation, treating residue with nitric acid or nitro gases and calcining.

141,034. Process of obtaining cellulose from vegetable fibres. Schwalbe, Germany. Boiling ligneous fibrous material with a solution of two parts sodium sulphite and one part sodium bisulphite at a pressure of 5 to 7 atmospheres.

141,046. Smelting process, Tharaldsen, Norway. An electric smelting furnace with side openings to introduce materials into the region below the entrance of the main charge.

141,164. Oxide of zinc manufacture, McIver & Hommel, England. Converting light zinc oxide into oxy-chloride which sets, expelling the zinc chloride by heat, leaving the heavy zinc oxide.

141,135-6. Colour Lake Manufacture, Ulrichs, Germany. Treating dyes with salts of heavy metals.

141,089. Cellulose Manufacture, Pfiel, Austria. Boiling raw material until the encrusting substances are swollen up, and removing the latter mechanically from the fibre.

141,243. Apparatus for making Sulphur Dioxide Gas, Jones, U. S. A rotary kiln with interior partitions and means of heating same.

141,325. Thermo Electric Battery, Suchting, Germany. Details of apparatus.

141,346. Fertilizer, Bash, U. S. Mixing phosphate rock, sulphuric acid and peat and drying the mixture.

CANADIAN PATENTS

Reported for the Canadian Chemical Journal, by A. E. MacRae, Ottawa.

183,314. A smelting and refining furnace with compartments provided with means for subjecting their contents to intense electrical heat, and for opening and closing discharge apertures. Otto J. T. G. R. Martin, Victoria, B.C.

183,345. A process to manufacture paper pulp characterized by cooking vegetable fibrous materials with a solution of ammonium bisulphite and a soluble sulphite. T. Marusawa, Fukuoka, Japan.

183,362. The method of effecting extraction of radium from carnotite ores and concentrates and other suitable radium containing material, by treating with nitre cake of a concentration and at a temperature to dissolve the components and recover the radium sulphates. Herman Schlundt, Godden, Col.

183,485. A metallurgical furnace, with inner and outer fixed annular structures and rotating annular structure, with annular hearths projecting in both directions therefrom. Utley Wedge, Ardmore, Pa.

183,496. An explosive for projectiles, etc., by employing hexanitrodiphenyl sulphide with carbon and other compounds.

183,497. The production of cap compositions by the use of hexanitrodiphenyl sulphide in crystalline or compressed condition. 183,498. The use of hexanitrosulphobenzide as a filling for shells, etc. The Canadian Explosives, Limited, Montreal, Que.

183,501. An explosive drying process comprising the removal of a liquid from a smokeless powder soluble therein by bringing into contact with a non-solvent oil miscible with said liquid by circulation of heated oil through the powder. The E. L. du Pont de Nemours Powder Company, Wilmington, Del.

183,534. A composition for protecting metallic surfaces against corrosion, consisting of orthophosphoric acid, a resin or shellac solvent therefor, and water. Don C. Westerfield, Dayton, Ohio, and Edward J. Rogers, Miamisberg, Ohio.

183,581. The process of making an alloy of a metal and phosphorus in an electric furnace, which consists of adding to a charge of phosphate rock and carbon a material adapted to supply said metal, passing an electric current through a portion of charge, and maintaining an excess of incandescent carbon to reduce the oxides as they form. Lewis Albert Jeffs, Salt Lake City, Utah.

183,805. A process for the manufacture of hexanitrodiphenyl sulphide. The Canadian Explosives, Limited, Montreal, Que.

183,873. A chemical reaction apparatus for the production of phenol, being a combination of pumps, mixing and reaction coils

and chambers, with mixing and separating tanks. A. M. Aylesworth and The Savings, Investment and Trust Company. Excrs., East Orange, N.J.

183,980. A soap composition comprising water, sodium carbonate, sodium acetate and ammonium acetate in fixed proportions. 183,981. A washing crystal consisting of water sodium carbonate, sodium acetate and ammonium acetate in fixed proportions. Morris Spazier, Los Angeles, Cal.

184,017. The recovery of metals from alloys thereof by passing an electric current from an alloy electrode to a suitable cathode through an electrolyte containing a salt of the metal to be deposited, reversing the polarity so as to avoid deposition of undesired components of the alloy. The British American Nickel Corporation, Limited, Toronto.

184,033. A paint or varnish comprising a bituminous or coal tar pitch, a suitable volatile solvent and compounds of the cumarone-indene group. The H. Koppers Company, Pittsburg, Pa.

184,032, April 30, 1918. Separating Certain Constituents from a Gas or Mixture of Gases, L. Bradley. Solid particles capable of reacting with the desired constituents are injected into the gas to form a cloud or mist which is then removed by the action of an electric field. Finely divided Ca (OH) 2 is used to absorb C1 and form a cloud of particles containing the C1. The humidity of the gas is controlled to provide effective absorbing action.

185,855, July 30, 1918. Apparatus for Forming Filaments, D. K. Wright, Can. The apparatus comprises a shaper on which the wire is stretched in zigzag form, means for actuating the shaper and stretcher and for heating each loop of the wire in succession.

186,097, Aug. 30, 1918. Recovering Gases, U. Wedge, F. A. Eustis, Can. SO_2 gases are absorbed in liquid, and heat and vacuum are simultaneously applied to the liquid for the recovery of the gases. The gases are deprived of any liquid which may remain associated with them, while under the vacuum. Apparatus is also specified.

186,104, August 20, 1918. The Production of Neutral Sulphate of Ammonia, F. Capron, Can. The crystallized acidulated $(NH_4)_2SO_4$ is washed with a practically saturated and neutral solution of $(NH_4)_2SO_4$ until the solution leaving the crystals shows no acidity.

185,853, July 30, 1918. Treating Drawn Metal, A. Pacz, Can. Drawn wire is held at red heat for a short period in an oxidizing atmosphere and then heated to white heat in an inert or reducing atmosphere. The wire thus treated is pliable and flexible and readily takes a permanent set.

185,733, July 30, 1918. Depositing Clay, Plumbago, on Moulds, B. J. Allen, Can. The material is introduced in a liquid state into an absorbent mould and an electric current is passed through the material between an electrode suspended therein and one in contact with the outer face of the mould.

186,184, August 20, 1918. Sodium Ferrocyanide, Boberg, T., Can. Na_4FeCN is separated from a solution containing mainly Na_4FeCn and Na_2CO_3 by evaporating the solution to about 80° C. and slowly cooling, with the pure Na_4FeCn crystals separating down to a temperature of 35°, when the remaining liquor is drawn off before Na_2CO_3 crystals separate out. The solution thus treated is prepared by treating a solution of alkali cyanogen with first Fe and then CO_2.

186,141, August 20, 1918. Apparatus for Separating Liquids from Solids, A. N. Nicholas, Can. The separator comprises a rotatable container, a filtering medium spaced from the inferior surface of the container, means for dividing the space between the interior surface and the medium into separate compartments, means for bringing these compartments in succession under the action of suction and cutting them off in succession after a predetermined period, and means for then subjecting the compartments in succession to a sudden fluid blast.

186,140, August 20, 1918. Process of Separating Liquids from Solids, A. M. Nicholas, Can. Liquid is separated by means of a vacuum filter and the solid material is removed from the filtering medium by means of a blast of air or other fluid.

185,847, July 30, 1918. Process for Obtaining Nitrogen from Air, N. C. Tommasi, Can. Air is passed through a solution of $(NH_4)_2SO_3$ on the counter current principle until the O is removed from the air to such an extent that N containing less than 1% of O is left for fixation.

185,854, July 30, 1918. Filaments, D. K. Wright, Can. The filament has certain portions which are more flexible than other portions, the greater flexibility being caused by a greater degree of heat.

184,914, June 11, 1918. Projector Arc Lamps, B. Perris, Can. The negative electrode of the arc lamp has a heavy Cu coating which is itself covered with a coating of Ni to prevent the beads of molten metal from collecting on the tip of the electrode and spattering the lens of the condenser when the arc springs therefrom.

186,155, August 20, 1918. Granulating Calcium Cyanamide, G. W. Sinclair, Can. Water or a watery solution is added to the Ca(CN) in a plurality of separate operations, the final addition being made at a lower temperature than the first. The product retains its granular form and will not lapse into the form of dust or powder.

186,160, August 20, 1918. Zinc Production, F. Tharaldsen, Can. The charge is placed in a horizontal layer in an electric arc furnace and heated to liberate the volatile constituents which are passed into a condenser and the residue removed. The furnace used is also specified.

185,670, July 23, 1918. The Production of Nitrogen Compounds from Metal Carbides, V. Thrane, Can. The preheated metal carbides are evenly spread over a layer of indifferent material, pulverized or in pieces, and carried against a moving current of N. so that the compounds may be removed with more or less of the layer of indifferent material.

184,817, June 11, 1918. Purifying Saturated Hydrocarbon Gases, J. B. Garnet, Can. Saturated hydrocarbon gases are recovered from other gases mixed therewith by passing the mixture through a body of charcoal. The saturated hydrocarbon gases are not taken up by the charcoal while the H_2S and other impurities are largely absorbed.

185,867, July 30, 1918. Improved Method of Briquetting, E. R. Sutcliffe, Can. Finely divided carbonaceous material is submitted to compression in stages to produce a briquette having a granite-like structure.

185,436. July 9, 1918. Alloy, H. S. Cooper, Can. The alloy containing Ni, Zr Al and Si is specially adapted for cutting purposes. The addition of Si to the Ni-Al alloy increases the hardness greatly and the Zr the physical and structural characteristics of the alloy greatly. A scleroscopic hardness of 65 to 75 is easily reached. W may also be added. The alloy comprises Ni 70 to 80 per cent.; W — 4-12; Al 7-8; Zr—6-7; Si 3-4.

185,443, July 9, 1918. Treating Oxidized Ores, F. A. Eustis, Can. Oxidized Fe ores containing one or more of the metals Ni, Co, Al or other Al heated in the presence of and intimately mixed with an excess of SO_2, thus rendering a large amount of the metals sol. The material is then leached and the Fe precipitated.

185,311, July 2, 1918. Potassium Salts from Kelp, F. K. Cameron, Can. The kelp is minced to form a magma which is treated with HC1 to flocculate the suspended solids and produce a coagulum which is separated from the liquor. The liquor is evaporated and the coagulum may be used for cellulose purposes after the extraction of the alginic acid.

185,367, July 9, 1918. Spiegel, A. M. Cromlish, Can. Mn is recovered from flush cinder by charging the flush cinder, coke and tapping cinder into a blast furnace where the charge is reduced and a low Mn high P spiegel formed. Dolomite may be used as a flux instead of the tapping cinder.

Canadian Government Publications

By L. E. Westman, M.A., Inland Revenue Department, Ottawa

[Notice.—Recent Government publications of scientific, technical or educational value, are reviewed here from month to month. Unless otherwise stated, these publications may be obtained free, by those interested, upon application to that department of the Government issuing the same.]

Canada Food Board

Food Laws, p. 72. Being a Manual of Orders in Council and Orders of the Canada Food Board, relating to the Production, Conservation and Distribution of Food, correct to June 22, 1918. Exact data covering the many orders of the Food Board is given here in legal form, and ignorance of the law cannot be taken as sufficient excuse for neglect in carrying out these orders.

"It is not claimed that these laws are free from defects, and some change may still be necessary. They have, however, been passed after careful consideration and their enforcement is in the interest of the public. Therefore, to make them effective, it is necessary that public opinion should encourage and support the police authorities in their enforcement."

Inland Revenue Department

Bulletin 383. Packaged Breakfast Foods, p. 35. Fifty-one different brands of material were found on the Canadian market. The detailed analysis of 275 samples is reported. The great popularity of these foods is due to (1) attractive and widespread advertising. (2) A saving of time, (3) cleanliness, (4) the attractive flavor. A table is given showing the relative cost of 1,000 calories of energy as supplied by each brand. The cost of equivalent energy values per thousand runs from 4.4 to 21.9 cents. Those made from oats are the cheaper and those from wheat and rice the dearer. Calorific values per 1,000 grams are given with some remarks on methods used in calculating these values.

Bulletin 384, Middlings (Shorts), p. 21. This feed must contain at least 15% protein, 4% fat, and not more than 8% crude fibre. It must also be free from noxious weed seeds. Among 203 samples a few only were found below standard and many of these were "compensated" in the sense that they contained sufficient excess of one ingredient to more than make up for slight deficiencies in the other. Ten samples contained notable amounts of vital weed-seeds.

Bulletin 385. Table Salt, p. 21. Only 14 samples in 198 fell below 98% sodium chloride. Matters of harmless nature were found added to prevent caking in some samples. These consisted of salts of magnesium and calcium. A few samples contained phosphates. On the whole this article retains its high degree of purity and many samples of Canadian origin fulfill all requirements of the United States Department of Agriculture.

Bulletin 397. Sugar, p. 23. Standards for this material require a purity of 99.5% sucrose. Icing sugar may contain 5% starch. The use of dyes in sugar refining is discussed as well as the relation of this to Canadian standards. Partially refined sugar may be sold as such, and a few samples of this kind ran as low as 85% sucrose. Their average moisture content was 3%. The "soft sugars" may be brown, yellow, or white, and may be sold under these names. 179 samples are reported.

Bulletin 399. Marmalade, p. 21. As far as Canada is concerned, the term marmalade is actually employed to distinguish a jam made essentially from oranges. Since it may be made from other fruits, it is difficult to fix standards. In 148 samples collected all but seven were orange products. The chief difficulty in the analysis of these products is the detection of added pectin in excess of the 10% allowed by law. This added pectin is very necessary in the case of oranges as they do not contain enough pectin themselves to form a jelly. This pectin is derived from apples, cores, and skins. Questions of relative cost values are difficult from the viewpoint of the analyst, since this added pectin may not be determined with any great exactness. The bulletin is a partial study of this point as well as a source of data on the composition of many well known brands.

Bulletin 400. Strained Honey, p. 17. This would seem to be one of the purest food materials on the market. Only three samples in 87 were found slightly adulterated. Standards in full are given in G. 1047 and allow only 25% water and 8% cane sugar.

Bulletin 402. Witch Hazel, p. 7. A discussion on distilled witch hazel as advertised and sold. The product contains 14% ethyl alcohol and while valuable as an alcoholic solution for rubbing purposes it should not be sold as a universal "cure." The question of its possible misuses as a beverage is considered. No potent harmful constituents are present.

Bulletin 403. Ground Allspice, p. 23. This work was undertaken upon advices of the importation into Canada of "spent" allspice. There are no Canadian standards for this article. A study of methods of analysis was made and comparative tables are given in condensed form, using United States standards in drawing conclusions; 188 samples were examined and the report shows evidence of much careful work.

Bulletin 405. Grape Juice, p. 17. This business has increased in the last few years quite considerably. Grape juice is legally defined under G. 947 as follows: Sp. Gr. 20 C. between 1.0400 and 1.1240; contains per 100 cc. not less than 7 or more than 28 g. of sugars calculated as reducing sugars; between 20 and 55 centigrams of grape ash; between 50 and 70 milligrams of P205. Ninety-five samples in 102 met all these requirements, while three samples were found to be artificial. No fermented samples were observed or preservatives found.

Plusieurs de ces bulletins sont publiés en français et l'on peut en obtenir des copies gratuitement de la manière indiquée plus haut.

Department of Mines—Mines Branch

Analysis of Canadian Fuels. E. S. Stansfield, M.Sc., and J. H. H. Nicolls, M.Sc. (in five parts). Each part is edited under separate cover and adjoining provinces are grouped in that way. Part (1) deals with Maritime Provinces, giving detailed analyses and results of coking tests on representative samples from various coal field areas as well as peat bogs. Part (2) deals with the bog deposits of Ontario and Quebec. These are fairly numerous and extensive. Miscellaneous samples of oil shales were examined, yielding from 7.5 to 10% volatile matter and from 1 to 6% fixed carbon. Part (3) covers peat bogs and coal areas of Manitoba and Saskatchewan. Part (4) covers Alberta and North-West Territories. The report for these areas is more extensive owing to the number of deposits they contain and their distribution. The growing importance of these particular formations makes detailed information relative to their nature of very practical importance just now. Part (5) dealing with the coal fields of British Columbia and Yukon Territories completes the series.

In general both proximate and ultimate analyses are given for all coal supplies as well as many determinations of sulphur and nitrogen. Data consisting in calorific values per gram and B. Th. U. along with fuel and carbon-hydrogen ratios follow. Coking properties and Hoffman potash tests were made and a complete history of the sample is given. Slightly less detailed information along similar lines is given on peat bog materials. The whole series of reports represents the compilation of much careful work, which should assist in bringing in the day of better conservation and more complete utilization of our fuel resources.

Department of Trade and Commerce—Advisory Research Council Reports

Besides annual surveys and valuable reports of scientific executive gatherings this council has adopted policy of pub-

lishing in bulletin form certain reports of general scientific interest. Three such reports have been issued recently.

Bulletin No. (1). The Need for Industrial Research in Canada. F. D. Adams, F.R.S. This brief discussion is adapted particularly to the purpose of stimulating the interest of the average business man along new avenues of thought in this direction. The more recent well-known achievements along many lines of work are touched upon. The necessity and significance of the present stimulus to industrial research is ably presented. Post war conditions in commercial fields are discussed. A summary of the thought follows. We are entering upon an era of unprecedented keenness and close competition in trade. The burden of the war debt will set such a pace that only those countries where progressive methods and scientific research united with big business, may hope to capture any market or hold its own. Canada must improve its condition among the countries of the world and may only hope to do so by working up its own raw materials to the best finished products within its own boundaries. The facilities for co-operative and broad industrial research in Canada must be extended. now and young Canadians must be given their opportunity through our universities, schools and by direct Government assistance, to prepare themselves for leadership later on.

Bulletin (2). Researches on Sound Measurement. L. V. King, F.R.S.C. Good work has been accomplished by Professor King in the testing of fog signal machinery. This is of special importance to Canadian shipping. The inefficiency of sirens and steam whistles of existing types is well known. Instruments for proper sound measurements were not available. The predominant type of fog-alarm in Canadian waters is a modified compressed air siren known as a "diaphone." It was observed that the note given by the diaphone at a distance was very nearly a pure tone. By the use of Webster's "phonometer" acoustic surveys were made in the neighborhood of Father Point. New information relative to "silent zones" was obtained, and it was discovered that the loudness of the sound did not decrease according to the inverse-square law for distance. Under no natural conditions was this law found to be even approximately true. By careful measurement involving electrical thermometers it was found that the efficiency of sirens used was about 8%, based on that of an ideal siren. With the assistance of Professor Miller, of Cleveland, Ohio, and his unique instrument for photographing sound waves (the "phonodeik"), it was learned that the sound from a diaphone, unprovided with a trumpet, was very complex. A trumpet of correct design concentrated a greater proportion of the power in the master tone. This tone alone seemed to survive at distances greater than two miles.

As a result of this work the acoustic characteristics of a siren may be determined with fair accuracy, in absolute measure. The intensity of the master tone has been measured and practical acoustic engineering has been advanced to the point where its further study may be undertaken profitably by a Government laboratory.

Report No. (1). Briquetting of Lignites. R. A. Ross. Full details relative to proposed plans for briquetting Western lignites are given along with estimated costs, etc. A summary of the report states:

1. The necessity exists for the development of all our fuel resources.

2. The best immediate returns will be secured by the development of lignite briquetting proccesses.

3. The country has the raw materials, the brains and the command of money for such national work.

4. Leaving the problem in private hands will result in long delays during which we must buy our fuel abroad.

5. In view of the broad national importance of the field the actual capital necessary is of secondary importance.

6. Full success will mean the stoppage of millions of outgo to the United States, and its expenditure in Canada.

7. If only a partial success be secured a step shall have been taken in a problem which must be solved ultimately.

8. A complete failure is unthinkable. . . ."

Commission of Conservation

Fire Waste in Canada, p. 304. J. Grove Smith. Canada has been facing annual fire losses, based on population, greater than any other country in the world, where conditions are known. This is a loss that may certainly be reduced by proper care. In our newer districts as well as in our cities and towns, the annual excessive fire loss goes on. Our insurance rates are thus made exceedingly high. The above report is in book form, and gives a very complete account of the whole situation with much data. Illustrations and graphs aid in making the points discussed more striking. Of particular interest is the suggestion that some government laboratory (most suitably the Mines Laboratory) take over the work of testing structural materials and fire protective devices. The Underwriters' Laboratories, Inc., Chicago, have more or less complete control over such work in America at present and it is suggested that the Canadian Government undertake and extend this work as far as Canada is concerned. The Canadian Manufacturers' Association are in touch with the Conservation Commission in connection with ways and means of bettering this rather bad situation. On the other side of the problem, Provincial Governments are beginning to get down to some real work as far as forest conservation from fire is concerned.

With regard to the transfer of certain services from the Department of Inland Revenue to the Department of Trade and Commerce, it is now officially announced that the administration of the Gas Inspection Act, the Electric Light Inspection Act, the Weights and Measures Inspection Act, the Adulteration Act, the Commercial Feeding Stuffs Act, the Fertilizers Act, the Proprietary and Patent Medicine Act, the Inspection of Water Meters Act (now administered by the Gas and Electricity Inspection Branch), the Weights and Measures Branch, and the Adulteration of Foods Branch, of the Department of Inland Revenue, are transferred to the Department of Trade and Commerce, with the officials now charged with the administration thereof. The change dates from September 1st, 1918. For the time being at least the duties of all officials connected with technical branches of the work will go on as they are now.

LAW CLERK, PICTURE MAN AND SCIENCE GRADUATE

During the month of May a technical clerk was temporarily required at the Topographical Surveys Branch of the Department of the Interior at a salary at the rate of $1,300 per annum, and it is stated that "applications will be considered from graduates in Applied Science, honor mathematics, or physics, of some recognized university." Qualified draughtsmen, competent to perform engineering and architectural work are offered $125 per month. By way of contrast, a "motion picture camera man" required by the Department of Trade and Commerce is to be given an initial salary of $2,400 per annum, and a law clerk an initial salary of $2,100.—The Canadian Mining Journal.

SUBSTITUTE FOR PINE OIL

As recently reported, the Forest Products Laboratories of the Forestry Branch of the Department of the Interior have found a substitute for pine oil, in one of the creosote oils thrown off as a by-product of the hardwood distillation industry. This by-product, which up to a short time ago had so little market value that a good deal of it was burned for fuel, is now produced at the rate of nearly twelve hundred gallons per day in Canada. The new oil has been further tested in the ore testing station of the Mines Branch at Ottawa, and found to be both efficient and economical, and the result is that the miners get a much cheaper material, and the wood distillation plants have a market for another of the by-products of their industry.

INDUSTRIAL NEWS

MacKinnon, Holmes & Co., Sherbrooke, Que., announce that on and after August 1st their business will be conducted under the name of MacKinnon Steel Company, Limited. The head office and works are located at Sherbrooke, while their Montreal office is at 404 New Birks Building.

The Spanish River Pulp and Paper Mills have recently completed the installation of six new grinders at Sault Ste. Marie, five at Espanola and nine at Sturgeon Falls, Ont., and there is now an output of ground wood pulp amounting to about four hundred tons daily. The company have been obliged to abandon for the present the establishment of a research department at Espanola, as no sooner have expert chemists been secured than they are called to military service.

The Titanium Alloy Manufacturing Co., of Niagara Falls, N.Y., has recently secured two Canadian patents—one for the manufacture of linoleum incorporated with a titanic material, and the other for the manufacture of rubber incorporated with a compound of titanium zinc oxide and sulphur respectively.

The Grasselli Chemical Co. have taken up an option on a pyrite property near Flour Station on the Kingston and Pembroke Railway. Already considerable diamond drilling has been done and a promising property developed. The hydro power is to be secured from the Calabogie Power Development.

Letters Patent have been issued increasing the stock of the Ontario Graphite Company, Limited from $200,000 to $300,000, and changing the name of the company to the "Black Donald Graphite Company, Limited."

Natural gas in Alberta is being tested to determine its value as a source of gasoline. Experimental apparatus is now being constructed and tests will be made at the principal producing points in that Province. The work is being carried out under the direction of Mr. D. B. Dowling, of the Geological Survey.

On August 5th, Judge Mayer awarded the Canadian Car and Foundry Company, Limited, and the Recording and Computing Machines Company, a verdict of $1,500,000 with interest, against the American Can Company on contracts for munitions for the Imperial Russian Government.

British Dyes, Limited, Huddersfield, have applied to the Patents Court for license to use for manufacture and research nearly 200 German patents. Some of these are unsealed patents, or patents sent for registry in that country shortly before war broke out and never registered. They are principally for azo-dyestuffs for cotton and wool.

F. C. Huyck & Sons, of Albany, N.Y., have purchased the business of Griffith-McNaughton, Limited, Arnprior, Ont., which they intend enlarging. At present, the plant is making blankets and socks for the Canadian Government, and it will later on make felts for paper mills. Mr. J. T. Griffith will continue in the management of the Arnprior plant.

The Metals Disintegrating Co., New York, announce the removal of their offices from 3 South William St., to 62 Broadway.

Discoveries of a fine quality of graphite are reported from Port Neville, about 120 miles north of Vancouver, and samples of strontianite have been brought into Vancouver from Osoyoos. New finds of silver are also reported from Mayo, Lookout Mountain, Yukon.

The Volta Manufacturing Co., Welland, Ont., manufacturers of furnace regulators and other appliances for electric furnaces have been making extensions to their works, which will double their capacity. The company recently acquired a foundry for the production of their own castings.

The Canadian China Clay Co. is putting in a crushing and washing plant at its works near St. Remi d'Amherst, Que., where there are large deposits of silica sands and kaolin. A sample of this china clay has been sent to this office for inspection, by those interested.

Chromite is being mined at Scottie Creek, near Ashcroft, B.C., and at Cascades, near the U. S. Boundary. Up to the beginning of August, 200 tons had been taken out of the Scottie Creek mine. Owing to the shortage of the domestic supply in the United States, and the cutting off of foreign imports, there is a great demand for chrome ores, and much attention is being directed to the Quebec mines, which were formerly large producers. Dr. Harvey, of the Department of Mines, is looking up the chrome ore prospects in the Black Lake district. The total shipments from the Province of Quebec are rapidly increasing.

The Government is extending the equipment of the assay office at Vancouver, for the purpose of smelting and refining on the spot the samples of new minerals that are being discovered in British Columbia and the Yukon.

Samples of platinum found recently in the Tullameen River district of B.C. have been sent to the Department of Mines, and the finds are regarded as promising. Messrs. G. C. Mackenzie, W. L. Uglow and Eugene Poitevin, of the Department of Mines are now investigating the platinum prospects in Similkameen, Peace River and other areas in the West.

A building to be used as an aeroplane spruce testing laboratory is to be erected by the Dominion Forestry Service, acting in co-operation with the University of British Columbia and the Provincial Government. Mr. R. H. Campbell, formerly secretary of the Canadian Forestry Association, is in charge of the work, with office in the Journal Building, Ottawa.

The new saccharine company to be established in Canada will be located at Walkerville, Ont., and will be financed by Hiram Walker & Sons, Ltd. We understand that the new works now being built will put the product on the market under the name of the Commonwealth Chemical Co.

Messrs. McKee and Thorne have started business in Toronto, in oils and chemicals, with offices in the Mail Building.

The Dillons Crucible Steel Co. are progressing with their new works at Welland, Ont. Mr. Dart, of the Electro Metals Co., of the same city, is interested.

Hon. Mr. Burrell, Minister of Mines for the Dominion of Canada, has appointed a Lignite Utilization Board to deal with problems concerning the future development and use of deposits of lignite coal in the west. Mr. R. A. Ross, consulting engineer of Montreal, will be chairman, and the two members will be Mr. J. M. Leamy, of Winnipeg, provincial electrician, and Mr. J. A. Sheppard, of Moose Jaw, Sask.

THAT POTASH LAKE

Some excitement in chemical circles was occasioned a few days ago, when a report was telegraphed from Saskatchewan, that a lake of sodium sulphate, from which millions of tons of potash could be extracted, had been discovered about 30 miles north of Maple Creek. Prof. MacLaurin, of the University of Saskatchewan, was said to have examined the samples, and to have pronounced them "perfect," and it was added that the Mackenzie and Mann interests were just two days late in coming in to file their claims. Nothing is known of this deposit at the Department of Mines, Ottawa, nor at the University referred to; and in the absence of Dr. MacLaurin in New York, no confirmation of the opinion attributed to him can be obtained. It may be said, in the meantime, that alkali lakes are not unknown in the prairie provinces. Hundreds of them bear soda salts and magnesium salts, and the contents of some of them will in time be turned to commercial use. However, the present report is chiefly interesting as proof of the invariable luck of Mackenzie and Mann. We have good reasons for stating that Dr. MacLaurin never made the report attributed to him.

BAUXITE FIND

It is reported that bauxcite has been discovered near Lytton, B.C., but no details are given. Bauxite, which is used in the production of aluminum, has not hitherto been found in any commercial quantities in Canada.

PERSONAL

Mr. W. F. Geddes, of the O.A.C., Guelph, has taken a position with the British Chemical Company, Ltd., of Trenton, Ont.

Mr. Hugh Lee, who succeeded Mr. Summerhayes as manager of the Porcupine Crown, is leaving that company to become lecturer on metallurgy at the Pennsylvania State University.

The Shawinigan Electro Metals Co. have opened a sales office at Cleveland, Ohio, with Mr. D. P. Falconer in charge.

Dr. A. W. G. Wilson, of the Department of Mines, is now investigating the cinnabar and other mineral deposits of the Hardy Mountain District, B.C.

Major R. W. Brock, of the 196th Battalion of Canadians, has been nominated by the Imperial authorities as an expert with the British forces in Palestine. Major Brock was dean of the faculty of applied science in the University of British Columbia.

Prof. A. J. Ledoux, professor of mineralogy in the University of Brussels, Belgium, died suddenly at Sudbury, Ont., last month. After the breaking up of his university by the war, Prof. Ledoux came to Canada as the guest of the University of Toronto.

Mr. C. S. Parsons, of the Mines Branch, Ottawa, has accepted the offer of superintendency of the Joseph Dixon Crucible Co.'s graphite mill at Graphite, N.Y.

Dr. Frank D. Adams, of McGill University, is now in England, where he has joined Dr. J. W. Robertson and Dr. H. M. Tory in reorganizing and extending the Khaki University for returned Canadian soldiers.

Mr. E. P. Mathewson has resigned as general manager of the British America Nickel Corporation, and has been appointed consulting metallurgist of the American Smelting and Refining Co., with headquarters at 120 Broadway, New York. Mr. W. A. Carlyle succeeds Mr. Mathewson at the British America Nickel Corporation, whose headquarters have recently been removed from Toronto to the Citizen Building, Ottawa.

Professor R. C. Wallace, M.A., D.S., Ph.D., head of the Department of Geology and Mineralogy of the University of Manitoba, has been appointed to succeed Mr. J. A. Campbell, as commissioner of Northern Manitoba.

Mr. M. L. Hartmann, formerly professor of chemistry at the South Dakota State School of Mines, has resigned to accept a position as research chemist-in-charge for the Carborundum Company, Niagara Falls.

Professor T. Brailsford Robertson, formerly professor of biochemistry and pharmacology at the University of California, has been appointed professor of biochemistry at the University of Toronto.

RECENT INCORPORATIONS

Montreal.—Dominion Refractories Co., Ltd. Leon Daoust. Capital $250,000. Metals, minerals, ores, chemicals and supplies.

Montreal.—Beaver Engineering Co., Ltd. Louis Gosselin, K.C., solicitor. Capital $100,000. Metals, minerals, chemicals, woods and fabrics.

Toronto.—The I. T. S. Rubber Co. of Canada, Ltd. Alfred W. Briggs, solicitor. Capital $200,000. Rubber goods.

Ferguson, B.C.—The Triune Gold and Silver Mining and Manufacturing Co. Richard Hoag Battery. Metal and mineral mining business. Capital $300,000.

Toronto.—Belcher's Islands Iron Mines, Ltd. Arthur L. Lillico, solicitor. Capital $1,000,000. Metal and mineral mining, and engineering.

Toronto.—Dover Oil Company, Ltd. John Steuart Duggan, solicitor. Capital $1,000,000. Ores, metals and minerals.

Toronto.—Contact Bay Mines, Ltd. Howard Addison Hall, solicitor. Capital $200,000. Metal and mineral mining business.

Wilberforce, Ont.—Molybdenum Products Co., Ltd. Robert B Elgie, wholesale merchant, Toronto. Capital $1,075,000. Ores, metals and minerals.

St. Catharines.—The Niagara Tool and Machinery Co., Ltd. Henry H. Collier, solicitor. Capital $40,000. Iron manufacturing, mechanical engineering and metallurgy.

Toronto.—General Research and Development Co., Ltd. Peter White, solicitor. Capital $100,000. Chemists, metallurgists and miners.

Toronto.—Canadian Odorless Disinfectant Co., Ltd. Thos. Hubert Wilson, solicitor. Capital $50,000. Chemicals and medical preparations.

Montreal.—The Flexner-Taylor Co. of Canada, Ltd. Walter Seely Johnson, solicitor. Capital $50,000. Asbestos, asphalt blocks and cement.

London.—London Oil Company. Jno W. G. Winnett, solicitor. Capital, $40,000. Minerals, oils and gas.

Montreal.—The British Smelting & Refining Co., Ltd. Edson Grenfel Place, solicitor. Capital, $50,000. Ores, metals and minerals.

GOVERNMENT CONTROL

Further control of Canadian commerce has been undertaken quite recently by the Government. By co-operating with the United States more fully it is hoped to better supervise imports and exports. In order that the United States Government might effectually enforce its export and import regulations in the interests of conserving ocean tonnage, it was necessary for Canada to adopt practically the same regulations as those in force on the other side of the line. By means of certain blanket licenses it was hoped to allow a measure of unchecked trade between the two countries. In general, however, metals and chemicals of all kinds may be exported or imported by license only.

During the latter part of July and early August, a number of schedules were issued from Ottawa and Washington, designed to make American regulations uniform. On July 18, 1918 a schedule was made applicable to Canada containing articles the export of which from the United States was subject to license. As usual, chemical items formed a very large part of the hundreds of articles listed. On July 18, Ottawa issued a further list of articles which could not be exported except by license. On July 27 further arrangements bringing export and import licenses into closer conformity for both countries were made. The lists also were extended. Following this, the Canadian War Trade Board approved certain general licenses covering the export of certain articles to the United States only. On the other hand, a number of articles are passed by our Customs as licensed for importation from the United States.

It may be seen then that no evasion of the restrictions of either country is now possible, and ocean-going traffic will not be disturbed for this reason. Essential war industries are thus placed on the same base in both countries. Further additions and modifications of lists are to be expected. Detailed information should be obtained from the War Trade Board, Ottawa.

CHEMICAL EXHIBITS

The Shawinigan Water & Power Co., of Shawinigan Falls, Que., had the Canadian National Exhibition, a booth in which were shown about twenty of the different chemical and metal products of that progressive centre of electro-chemical developments. This exhibit, with other interesting additions, will be taken to the Chemical Exposition in New York.

Among other exhibits, the Barrett Co., of New York and Toronto, also exhibited a set of samples of 35 coal tar chemical products made at their various works, and showed besides, a collection of their various tar products applied to building and to road construction and maintenance.

The varied exhibits of metals and minerals by the Ontario Bureau of Mines was among the most instructive feature of the exhibition.

BRITISH DYE INDUSTRY

In an interview with Mr. Fred. W. Field, British Trade Commissioner for Ontario, with headquarters in Toronto, the representative of the Canadian Chemical Journal was informed that important action has been taken by the British Government, through the Board of Trade, in regard to the production of synthetic dyes. These products constitute some of the "key" industries, for the supply of which the United Kingdom had allowed itself to become dependent upon Germany. While the imports for German dyes was not large, yet upon these indispensable imported dyes depended a great British export trade, a very considerable home trade, and a miscellaneous business in many commodities other than textiles, into which dye stuffs entered in some form or other. The British Government's action is divided into six heads:—

(1) The formation of this State-aided limited company designed to be the nucleus of a large dye manufacturing industry; (2) the winding-up of German dye companies in the United Kingdom and the sale of their works to British firms; (3) the encouragement of private enterprise; (4) the provision and distribution of essential supplies of raw materials; (5) the development of the Swiss sources of supply; (6) the control through the War Trade Department of exports of dyes and of substances containing dyes.

Broadly stated, the present position is as follows:—The British manufacturers are now able to make the ordinary common dyes in sufficient quantity to meet the war demand at home and, to a considerable extent, the demands of our Allies. The common dye problem has been solved and the industry should be able—after a period of special protection as a "key" industry—to hold its own in the world's markets after the war. But when one turns to the dyes more difficult of production, of which Germany held a practical monopoly before the war, the progress has been considerably less marked. The deficiency is for the present being made up to a large extent by supplies from Switzerland. Special arrangements have been made with four Swiss firms, who are manufacturing dyes for the United Kingdom from British materials, and these arrangements have proved of the utmost assistance to consumers in Great Britain. Nevertheless it cannot be overlooked that a number of the special dyes which will be required by British users after the war are not yet being made outside Germany, though their manufacture is being promoted as rapidly as present facilities permit.

U. S. CHEMICAL WAR SERVICE

A new department of the United States military service has been formed in the organization, at the direction of the President, of the Chemical Warfare Service of the National Army. The head of this department (Major-General Wm. L. Sibert) is known as the Director of the Chemical Warfare Service, and, under the Secretary of War, is charged with the duty of operating and maintaining, or supervising the operation and maintenance, of all plants engaged in the investigation or production of toxic gases, the filling of gas shells and in the necessary research connected with as warfare. This branch of the service is to remain in force for the duration of the war and for six months thereafter. It is hoped that the department will be represented at the Chemical Exposition in New York, this month, in which case, some of the devices and chemically produced appliances of the war will be shown.

DISCOVERIES OF MANGANESE

The discovery of manganese ore in the Cowichan Valley, Vancouver Island, gives promise of permanent production of this much sought for mineral in British Columbia. The ore is found in more than one place and one of the largest deposits has been found by a returned soldier, Mr. Service, who had returned after serving in the engineering corps, and was in the fight at Hill 60. One assay showed over 50 per cent. of metallic manganese free from phosphorous and containing not more than 12 per cent. of silica. It is said that two thousand tons of this ore have been disclosed, and the finds have greatly impressed Premier Sloan, who is Minister of Mines of the Province. Their location so close to the Nanaimo coal fields is very favorable for manufacturing.

A discovery of managnese is also reported from the Blomidon shore of Nova Scotia, and it is stated that an expert of the U. S. Steel Corp. has been sent to examine the prospect.

AUSTRALIAN ZINC

The British Government has contracted with the Australian Government to buy the whole of the output of zinc concentrates in Australia for the rest of the war period, and for ten years thereafter. This new contract, replacing the old contract, gives Great Britain full control of the material which in normal times governs the zinc trade of the world. It provides protection for the zinc interests of France and Belgium, and will ensure stability for one of the most important Australian industries. Australia produces 400,000 tons of zinc annually, and the original scheme provided for the purchase by the British Government of 100,000 tons per annum until 10 years after the war, as well as 45,000 tons per annum of spelter produced in Australia, which represented an additional 112,500 tons of concentrates, the sum involved being about £25,000,000.

CENTRIFUGALS AT THE EXPOSITION

At the New York Exposition of Chemical Industries, the Tolhurst Machine Works of Troy, N.Y., will exhibit several types of centrifugals developed since the war. Among these is the Tolhurst Center Slung Centrifugal, especially adaptable for handling large loads of material rapidly and efficiently. They are also exhibiting the Tolhurst 1918 model Suspended Centrifugal with bottom discharge. The development of this machine is the result of the demand of the chemical and explosives industry for a suspended centrifugal of the most durable and rugged form of construction, at the same time permitting a very rapid acceleration and stopping. These and other types will be shown in operation.

RECOGNITION " HERE AND THERE."

Percy Haughton, president of the Boston Braves Baseball Club is made a major. The president of the St. Louis Cardinals is made captain, along with two world noted players, Ty Cobb and Christy Mathewson. These four choice appointments have all been made in the Chemical Warfare Service of the United States Army. Doubtless Lt.-Col. Marston T. Bogart, Prof. G. N. Lewis, and other leading American chemists now in uniform, both in France and the United States, will rejoice at this reformation caused by the war. We only wish to note, in passing, that the Canadian authorities have failed so far to recognize chemical talent as worthy of a uniform, either in any of our local ball players or among our chemists. Those delightful sessions with grandchildren, which are promised all slackers, will doubtless overtake the unfortunate Canadian chemist yet as one of the remote results of the great war.

KILLED IN ACTION

Mr. Albert Nieghorn, manager of the Nichols Chemical Co.'s Toronto house, is among the many who have suffered bereavement in the war. His only son, Lieut. Karl Nieghorn, with the Canadian forces, was recently killed in action in France, but it is not yet known here in what battle he fell or the circumstances of his death.

RELATION OF RESEARCH TO INDUSTRY

At the last general meeting of the Chemistry Committee of the Honorary Advisory Council for Scientific and Industrial Research, held in Ottawa, the question of the proposed Central Research Bureau and its relation to industrial development was discussed.

In opening the discussion, the chairman, Dr. R. F. Ruttan, said:

Two questions are of special importance, viz: (1) with regard to a Central Research Bureau to concentrate and centralize research for chemical industries, and (2) the advisability of granting patents to government employees. Dr. Bates has been good enough to introduce a discussion with regard to scientific work in the departments in Ottawa, and also a reference to the very difficult question of the advisability of granting patents for valuable discoveries made by government employees. Our research students and research fellows and those who are working under grants from this Advisory Research Council may be regarded as government employees to a certain extent, and they should be under regulations similar to those which would be used in the case of the employees in the various scientific departments in Ottawa. Now, we have had one case of a research student who in the course of his work found or thought he had found a new process for preparing a commercial process of value. This case led to a general consideration of any government employee coming across a patentable process or part of a process which would be patentable, and the question is, "How should we protect that?" "Should we grant him a patent or should the government patent it and give some other reward to the discoverer?"

Dr. Bates, taking up the first point regarding co-ordination of government scientific branches, said: There is not much I feel like saying on this topic, since it is a government proposition, and one or two members of the committee are connected with the government service. Our suggestion was made to the Research Council in the hope that this advisory body could work out some scheme of bringing the government service branches closer together, and giving us the benefits of a large corporation, and not merely leaving us with the difficulties of a large and non-unified government system. The suggestion I had in mind was that a meeting of the heads of government scientific branches might be called in order that, in a more or less informal way, the scientific men in the government service should talk over their mutual problems and develop some kind of a spirit of co-operation which isn't an unknown factor in government scientific work, although some of the public seem to think it is unknown. We have been very successful on one occasion in co-operating with the Mines Branch. I do not think there is nearly as much jealousy among the different branches of the government as some people think, and I do feel that a great deal could be accomplished in developing more esprit de corps among the men of the government service. If there is not a decided improvement, I am afraid that there are some of us who won't stay in the government service indefinitely. I don't mean by that that there is any crisis, but I do not feel the service is all that it should be, and that the government is not making the fullest use of the facilities which they have.

The other question of patents is one which originated from the Forest Products Laboratories some time ago. We find that some original ideas are cornered by members of our staff, and there seems to be no government regulations regarding the patenting of the idea of process. Our feeling was that a member of the staff should have a large share in the benefits of an invention, and that the government should assist in the commercial development of the idea if it were considered commercially feasible. A great many ideas of a chemical or general scientific nature are left without working out the commercial development. One point is, then, that the government should undertake to work out commercial ideas that we consider good. The sharing of the patent rights by the individual was considered a sound principle, because it would give an incentive for a man in the government service to develop his work, and the point is that if he were not given a share, as soon as he completed an idea, he would leave the government service and, as a private individual or with a private company, reap the benefits. Of course, the assumption is not that every new idea is going to be profitable and work out commercially. The decision regarding the share that the individuals would have in patents was to be left to a board appointed for the purpose, who would assign to the individual the share of the profits, or patent the rights that they consider he should have, and assign the balance to the government and draw up regulations for a private company carrying out this idea commercially. No set rule was suggested, since such matters depend so much on the individual case. The idea was to give the foreign rights on any patent entirely to the individual, only in Canada would the sharing of the patent rights be expected between the individual and the government. The Research Council has considered this matter and passed a resolution as follows:—

"That experts in the government service be allowed to patent in their own name their discoveries and inventions, provided they assign half of their patent rights in Canada to the Government of Canada, to be devoted to scientific research—the rights outside of Canada to be retained by the patentee."

Dr. Ruttan: The resolution passed by the Advisory Council is very much on the lines of what Dr. Bates suggests. This resolution was sent about to the different departments in the Government, asking for suggestions and other conditions, and as many as there are departments, so many were the different solutions offered to this committee. They were almost unanimous in the opinion that the discoverer should reap benefit from his discovery. I thought it would be very helpful if we could, without being influenced by any preconceived notions, discuss it on its merits, the problem being, "Should we grant a patent or a portion of a patent to anyone who is working in the service of the Government who obtains a new idea in the course of his regular work?" Of course, if a man working on chemistry were find to out something in regard to some mechanical process after hours, and should work this out in his home or elsewhere, the Government should, of course, not interfere with him obtaining a patent, as it was found perfectly independent of his regular work. But when a reaearch student or fellow finds something in the course of his regular work, should we grant him a patent or should we not? I don't want to prejudice the question, but the Bureau of Standards at Washington will grant no patents at all. I spoke to Mr. Stanton, head of that department, and he pointed out that it would be impossible to grant patents to inventors because every research man was assigned a certain bit of work, and many of these problems which are very important to the country, have no elements in them of anything patentable, while others might have a result which would be of commercial value. The consequence would be trouble in the department; men would object to work on problems that would not lead to anything patentable, and they found it impossible to allow any member of that department to have a patent. At present, we have no bureau corresponding to the organization of the Bureau of Standards, but if we had, it seems to me their regulations are sound. I don't think this should apply equally to all departments in Ottawa, and still less to the men engaged in subsidized research or research fellows. The Advisory Council would rather encourage those doing research under its auspices to direct their attention to problems of commercial value.

Dr. Birchard—I understand the policy of the United States Department of Agriculture is similar to that of the Bureau of Standards when any discovery would be solely for the benefit of the people of the United States. The scientist gains no benefit whatever when patents are granted.

Mr. E. A. Le Sueur—It seems to me from a rather wide experience in this field, that Canadian inventors should be fully

contented if they are given the right to apply elsewhere in the world for patents, and in view of the comparatively small field Canada offers to patentees they are very highly rewarded by the possession of such privilege. The more you look into it the more objections you will find to the granting of domestic patents in the circumstances under discussion, If it were merely a case of a young man employed by the Government on routine work, devising something of value, I should say there would be no objection. What we are discussing, however, is the case of a man employed under circumstances where, if he is at all the right man for the work, it may be impossible that he should avoid coming, at the Government's expense, on something that the present liberal practice of the Canadian and U. S. offices considers patentable. Should he take out a Canadian patent, it would give him a monopoly as against the Government which financed, facilitated, and even largely directed his research. But aside from that consideration, there comes up another. If the employee is going to have a fraction, say a half, interest in a resulting patent, he will naturally sit back and expect that the Government will do the financing and take the other necessary steps to make the patent pay and will expect half the resulting profits, whereas it is well understood that the financing and commercial exploitation of patents is by far the most costly and difficult thing connected with them.

Dr. MacLaurin—This subject is a very interesting one for me, and one upon which the Chemist Assembly in Saskatoon, December 30th, 1916, passed a resolution, and which I asked them to forward to the Research Council at that time, It is as follows: "We beg to recommend to the Council that a scheme be outlined which will ensure in the case of a research subsidized by the Council and leading to a discovery, invention or improvement shall be protected and recompensed, and that any firm or corporation using this discovery, invention or improvement shall return a certain percentage of the profits accruing therefrom to the Government for the purpose of establishing and maintaining a national research fund."

Dr. Bain—I have been connected with a commercial concern for ten years. We have had some little experience with this patent business. There are two things that I think are very obvious. First is that there is a large supply of chemists in the country who have two possible employers—the Government, by the Government I mean not only the Federal Government, but the local Governments—and private corporations. The Government must make its terms so liberal that there will be an inducement for it to get good men. Secondly, one has to take into consideration the commercial practice outside. I am not aware of what the practice is in many of the large companies, and I was very much interested in hearing Mr. LeSueur's statement to you of Mr. Westinghouse. I know this to be the case in a number of the big companies. Men who are employees of corporations are not only permitted to take out patents, but they are encouraged to do so, and usually under some condition, such as giving a percentage of the profits or receiving a royalty if it is taken up and worked within certain period. I happened to be at the Dupont Co's works some eight years ago, and I enquired particularly about that. They offered to all their chemists a royalty which was stated (don't know exact percentage) on any invention taken out by the company and worked. The result of that was some men in the laboratories were making very considerable incomes apart entirely from what they were paid by the corporation. Now suppose that a chemist comes into the government service and does discover something that is valuable, he is going to be guided in what he does with that invention by the record of the government. If the Government has put itself on record against allowing him to take out a patent, he naturally resigns, and goes outside with his invention, and I don't know that there is any law to stop him from doing that. There is a law in the United States by which an employer may sue the employee who is accused of having perfected an invention while in the service of the corporation and subsequently left. The law is idiotic. It appears to me that it would only be fair and wise that some condition should be adopted through the Research Council by the Government in that a certain percentage or royalty be paid to any of its employees who discover something and patented it which afterwards turned out to be valuable. Otherwise, the result will be that the men in the Government service who see anything ahead of them, will be rather inclined to drop out of the service and patent their inventions. There is another feature of the case. Chemical patents, in my opinion, are less valuable than all other patents. Take a penknife; a good mechanic will tell you almost exactly all the workings through which that instrument goes. A chemical patent is much more easily infringed as the patent exposes the process, but the product may not. That has to be considered.

Dr. Goodwin—I don't think, Mr. Chairman, that I can let the occasion pass without giving my views on the principle, which I think is a sound one, that if the departments of the Government where scientific men are exployed expect to get the best men in the country and expect to keep them in the employ of the country for the country's good, they must see to it that they are recompensed for their work, and are on a par with what they would be able to get outside of the employ of the Government. Otherwise, the same thing will happen as what happens in any business, or any university which departs from that policy, and depends altogether on the usual policy of giving a minimum salary and increasing according to length of service. What will happen will be a gradual slowing down from good to mediocre, that has happened in many cases under my observation, and therefore one of two plans should be adopted by the Government, not only for these assisted researches and things of that sort, but for civil servants as well. They should be given patents on their discoveries without any conditions as to whether they hold for Canada alone or for other countries. All questions of that sort should be removed. Of course I don't know whether it would be advisable or not.

Mr. Wardleworth—I may say on the industrial side, that the method employed by our company (National Drug & Chemical Co.), is this. When a chemist is under contract, any process which he may discover or invent during the work he is doing is supposed to be the property of the company, but he is awarded in proportion of the value of that discovery or invention. It does not apply to all inventions for the very simple reason that sometimes a process may be patented, or a new one evolved and the process may, after modification, be patented by some one else and become the property of the company without its being developed in any way whatever. But the principle we follow is the one that, those who make the discovery or the improvement are entitled to some reward and compensation. That is the principle that is adopted, and it is expressed in their contract that anything they may discover has to be the property of the corporation, but they are entitled to their share of the reward. Now Dr. Goodwin has referred to the commercial principle as applied to the Government, and I certainly do not see why, if we give research fellowships with the contingent possibility of the research fellow making some discovery, that he should not be rewarded. I do not see any reason why the permanent scientific staff should not have the same opportunity. Now the plan adopted by the Mellon Institute of Pittsburg, I think is ideal. A fellowship is given for one, two or three years, and when the research is completed, and if successful, the fellow is allowed to reap material benefit from the work that he has done. It makes an obvious incentive for everybody to do the best they can. It would be the same to the scientific men of the Government, if they felt that there was an encouragement for the work they are doing. They would perhaps think deeply about inventions when not in the laboratory, and the results might be discovered in the laboratory itself.

Dr. Ruttan—I may say that in the Mellon Institution, the

conditions are different, because there the fellows are paid by the industry. They receive salaries from $3,000 to $10,000 a year, and of course all work carried on in the Mellon Institute, is kept secret, and the employers of these fellows reap the benefit, but the fellows usually get bonuses from their employers if their researches are successful.

Mr. Wardleworth—May I add here that the contingent liability to the research in the Mellon Institute is this, that the industrial employer of the fellow is not allowed to reap the benefit beyond a limited period, three or four years.

Dr. MacLaurin—It is equally important that the general public should be recompensed as well as the individual, that is where the corporation uses the results of an individual derived from the public funds, that that corporation should be under obligation to return a certain part of these profits, at least, to the national research fund. At the present time, money is all given out for these research scholarships. Seems to me that in the course of time, as a result of this research, work would accrue special funds which would keep up the work of itself and independent of any special grant. It seems that side of it is perhaps more important. The individual research, of course, will be protected by his patent, to which he is absolutely entitled, in my mind, and the whole country is benefitted by that scheme.

Dr. McIntosh asked as to the share the Government should have after granting a patent, in protecting it from infringement. Would the Government, if interested in the patent, take suit to protect it?

Dr. Ruttan—I should imagine the Government should defend its rights in a patent, if these rights were valuable, but I do not know the legal aspect of this question.

Dr. McIntosh—I am afraid that as the Government grants the patent, it would be looked upon as an interested party.

Dr. Adam Cameron—I have nothing to add. I only want to say that I sympathise very much with the problem as outlined by Dr. Bates, that the Government employees should benefit. It is a well known fact that particularly in the old country a Government employee is not recompensed to the same extent that an employee of a corporation is, and on that ground, I think the Government employee should get all the incentive possible to stay with the Government and work out problems for the good of the country. In this connection, I might also say that the latest I have heard from some friends of mine in the old country, is that chemists there now reap very large benefits from scientific work, and are looking forward to protecting themselves when the war is over, by trade unions or otherwise.

Mr. E. A. Le Sueur—I will allude again to what I started to say: That if a man is paid by the Government and put in the way of doing original work and is allowed to take out U. S. and other foreign patents, he is thereby rewarded very richly indeed. Canadian patents average to sell for the merest fraction of what U. S. patents do.

Mr. Wardleworth—The point raised by Dr. McIntosh is a very important one. It might be possible to give the patent to a corporation and entrust it to one corporation to work, and that corporation would be responsible for protecting that patent, and for rendering all gains in reference to it. That is to say, it would pay to the Government and pay the returns which were due to individuals and the Government would be relieved of any bonus for the protection of the patent.

Dr. Ruttan—This discussion just goes to show what extremely different questions have to be decided by the Advisory Council. We all agree something should be done to encourage research in the various departments, but the question is, what is the practical way to do it? I am sure that when we read over the results of this discussion, we will be advanced towards a decision of the subject. This discussion will be very helpful to the Advisory Council.

The next item on the programme is the question of the advisability of a central research bureau in Canada. Now we have here with us this evening, the Administrative Chairman of the Research Council, who has given a great deal of attention to this subject. I was going to bring it forward myself, but I am sure you would rather hear him. He is conversant with all the phases of the question at the present moment, although I have not suggested it to him before. I will ask Dr. Macallum if he would care to set the case before the members of this Committee.

Proposed Central Research Bureau

Dr. Macallum—It is rather out of my place, of course, to address the Associate Committee on Chemistry, because I think its decisions should be uninfluenced by the views of members of the Council, except of him who presides over you. He is the intermediary, so to speak, between the Council and yourselves.

On one particular subject I can speak briefly, because it is one to which you have not given any consideration, perhaps, but you can help in making the view accepted, which the Council has adopted. We have given a great deal of attention to the question of how to enhance research in Canada. That is what the Council is constituted for, to promote research in pure and applied science, and in science in relation to the industries. You are all aware of the condition in Canada of research. We know it from the results of the questionnaires which were distributed amongst the industries for ascertaining information on this subject, and have been returned. There is less than one and one-half per cent. of the industrial firms that maintain research laboratories. That indicates the situation. It might be said, of course, that a large number of industrial concerns do not require research. There is, however, a certain proportion of them, about 40 per cent., for which research would be a valuable factor in their development, and yet less than 1½ per cent. report having research establishments associated with them, or that they are supporting research. Now one of the reasons for this condition is the fact that a great many of our industrial companies are not wealthy enough to undertake and support research. That is true also of very many firms in England to-day. It is impossible for firms with about £100,000 capital each to undertake researches of its own with any prospect of success. To enable such to provide for research, the British Research Council encourages the firms in each particular line of industry to form Trade Associations which will pool their funds for research and thus enable them to undertake research on a large scale and with every chance of winning material benefits therefrom. That proposal is now being widely accepted. There are over a dozen associations already formed, some of them with $3,000,000 to $5,000,000 capital, and several with an annual budget of $1,000,000, to promote research. In this country, we have only a few lines of industries, about a dozen altogether, in which the same could be achieved. There is one organization, the Tanners' Association, constituted of about 20 firms. Another, that of Pulp and Paper, which has a membership of more than 30 firms, which has done very little for itself heretofore. If these organizations should unite together and pool their funds for research, they would be in a way to meet the situation, and the demands which competition will make upon their trade after the war. Now this is one solution of the situation that has presented itself to me. I have proposed, with the approval of the Research Council, the formation of guilds for research in these associations. These guilds should pool their funds for research, and they would thus achieve what no single member of a guild could do. Now, further it is proposed that laboratories be erected in association with a Central Institute for Research, in which the research staffs of the guilds could be given accommodation and be under the supervision of the technical staff of the Institute. Such laboratories would afford practically the same advantages which the Mellon Institute of Pittsburgh gives. The Central Institute would parallel the Bureau of Standards at Washington or the National Physical Laboratory of Great Britain. We have no organization in Canada which answers to the Bureau of Standards. In Germany, France, and Italy there are organizations of this character. Japan, as I learn, lately considered the whole

question, and, as a result, it has amalgamated a number of research organizations, which perform all the functions of the Bureau of Standards. We may see from the situation in the United States, how matters are shaping in industrial research. The Bureau of Standards at Washington, though it concerns itself with all measures, standards and composition of material, departs from this public function on occasions to undertake work for the benefit of private firms, at the cost of the latter if the results are not of general public benefit. If they are, then the researches are carried out at public expense. It, therefore, attempts to favor industrial research after the manner suggested in the proposed Central Institute for Research. In the United States there are also trade associations, for example, The National Canners' Association and the National Lamp Association, which maintain large laboratories for research along their own particular lines, and the prospect is that these associations will increase in the near future, just as they are developing in England. It is possible that these associations may come together and organize for more effective research at one or more central points. The example set ought to be followed in Canada. It is hoped that the laboratories associated with the proposed Central Institute will place the Canadian industries in this respect on a level with the American industries, although the former are less supplied with resources for this purpose and, therefore, unable to do what the trade associations in the United States will accomplish. The assistance that the Central Research Institute would give would make up for the lack of the large resources at the command of the American associations. It is hoped that the proposal to form a Central Research Institute with laboratories for the guilds will be accepted by the Government of the Dominion, and that immediately an appropriation will be made, which will enable the work on the foundation of the Institute to begin before a year is over.

Dr. Ruttan—The points that are debatable in connection with this problem are, first: To what extent should the Council encourage research in Universities and guilds as compared with that which will be carried on in a Central bureau or a central research institute? Research is carried on normally in the Universities as part of its regular activities, not necessarily industrial research, but various forms of research are carried on, and researchers are trained in the Universities. It is, therefore, necessary that the Council should take cognizanze of that fact, and should do something towards helping the Universities to develop the material out of which researches are made. That is, research students, chemists, physicists, and so on. Now, it has been advanced by some to put the other side of the case—that research should be carried on chiefly in the Universities, and that the research institute, which we are all so much interested in, should be a secondary thing, and not the great crowning stone of research for the whole of the Dominion, and that a certain number of research men should be distributed among the various universities at the expense of the Advisory Council wholly or largely, and in that way we would meet the wants of the various problems in the different localities with regard to local research. On the other hand, the establishment of a large central research laboratory or institute would not only tend to develop research by co-ordinating research, having a group of men who are capable of carrying on research in various branches of science under one roof, but would, I think, sooner or later bring together the various departments of the Government engaged in scientific work. They might in the course of time, as the development in connection with the various departments would go forward, as a part of the plan, be brought under the same roof.

It is possible, not immediately, perhaps, but in the future, that we would gradually build up a great centre where research would be the main object. A large amount of routine work must always be carried on in connection with the various departments of the Government; but, also there would be an incentive, to the better men in these departments, to go into research, and in addition to that it would be a goal to which our students and graduates might aim. It is a difficult thing to do to get a young man to spend two or three years after his ordinary undergraduate course in perfecting himself along a comparatively narrow line, in order to become very perfect in his work, because there are no openings for men who pay that amount of time and money on their education in this country.

In the event of our having a large central research institute, it must be well manned. The men in higher authority there should be on a par with the directing research men in the United States, who receive $15,000 to $20,000 a year, and there would be openings for young men there who feel themselves to be capable of doing research. I think that that will be one of the great advantages of having a large central research laboratory or institute. In addition to that, of course, it would have the advantages so well set out by Dr. Macallum, that we would have in Canada a central authority for our standards. All of our big industries in Canada require standards. Textile trade, pulp and paper, paint, all require to have standards. Now, I don't want to prejudice the committee too much in favor of this central research institute, because we would very much like to hear any arguments which may be made in favor of any other methods of developing research in Canada. Probably the best way would be to help all the different lines of research. Help the Universities to bring together these guilds or organized industries, and also to establish a central institute combining the features of the Bureau of Standards and those of the Mellon Institute.

Dr. Goodwin—We have all listened with the greatest interest to Dr. Macallum's statement, and to the Chairman's opinion, and we all sympathise with the idea there put forward of having some general central institute which would act towards the Canadian nation to perform functions somewhat similar to that of the Bureau of Standards at Washington, but it seems to me that in the statements which have been put forward, the Bureau of Standards' idea has been very considerably departed from, and it leads me to suggest that, before any action of this sort is taken, we should have a careful enquiry into the strength and weakness of our whole system of education in Canada, and particularly that part of it for which the Universities stand. It seems to me that there is a growing feeling, not only in Canada, but throughout the English speaking world in particular—I don't know how far it extends—that our attempts at formal education very largely fail to hit the mark, because they don't take sufficiently into account the direct influence of education upon the preparation of the individual for his life in the country as a citizen, and there is a growing feeling with regard to the Universities particularly that they fail very largely to discharge these functions because they are more or less cloistered. They don't keep in close touch with the activities of the nation, and it seems to me that this idea of a central research institute may be developed in such a way as to make it still harder for the Universities to get and keep that close connection with the main streams of activity of the nation, which they ought to have if they are to be the strong factors they should be in building up the nation. I put this forward as a matter that I think should receive our most careful consideration, and the most careful consideration of the Advisory Research Council before we are committed to such a general venture into a central scientific research bureau as I take it has been outlined for us to-night. I myself, would suggest that before we do that we should consider most carefully what you, yourself, sir, have suggested as another method of encouraging research, viz., of utilizing the facilities which lie at our hands in the Universities. Our universities in that respect, are far from perfect; they need nourishing, they need all the intelligent energy that we can put into them to make them what they should be, and it is, I believe, a sound principle in progress, to utilize the means which you have at hand first, and make the most of them before venturing too far upon new enterprises.

(Continued in next issue.)

Chemical and Metal Markets

The Quotations below represent average prices for the quantities indicated. Larger quantities may be obtained at lower figures.

TORONTO, Sept. 14, 1918.

The markets are in a more confused state than for months past. In many lines of chemicals the old prices stand in name only, for when certain articles are not to be had, the prices offered are far above the market quotations.

The above remark applies to carbonate of ammonia, potassium nitrate, caustic soda and to some other items which are almost unobtainable. There would seem to be an abnormal commandeering of chloride of lime, etc., by the Government for poison gas, and the civic industries are left in a hole for bleaching materials, thousands of tons having been taken off the market recently. The new U. S. Government plant, which will turn out 200 tons per day, is to be in operation next month, and this will ease the situation. Meantime, chloride of lime and sulphate of soda and sal ammoniac are rising in price.

The U. S. Government will not allow sugar of lead to be shipped out of the country, and the sale of chloroform, both in Canada and the States, is forbidden for all purposes except in medicine.

Potassium permanganate and carbolic acid are at least two items that are cheaper. The latter is being released in greater quantities from England for the Canadian market.

The news that the Riordon Pulp & Paper Co. are building at Merritton, Ont., an electrolytic plant for flaked caustic soda will bring a needed relief to the industries that require this product.

An interesting change in the metal market is the tumble taken by tin. This is due to the arrangement made between the British and U. S. Governments by which larger supplies from the east will be allotted to America. More than 3,000 tons came over in August, and Straits and Singapore shipments due in October are offered at about 80 cents.

The Canadian Government has agreed with the U. S. Government for a uniform price of $105 per ounce for platinum. The U. S. Government has also agreed with the producers of aluminum for a price on that metal. The base price for aluminum will be 33 cents a pound, free on board United States producing plants, for fifty tons and over of ingot of 98 to 99 per cent., effective from 1st September to 1st March, 1919.

It is interesting to note that owing to the shipping economies the Canadian Mint is now supplying the silver coinage for Newfoundland. The export of silver from Canada, either in bars, bullion or coin is now prohibited except under license.

Acetanilid, C.P.	Lb.	1.10—1.20
Acetic acid, commercial, crude, 28% in bbls	Lb.	10——10
" " 80 per cent. pure	Lb.	.35—.37
Acetone	(Nominal)	
Alcohol, grain, bbl	Gal.	8.50
Alcohol, methylated, bbl	Gal.	1.65
Alcohol, wood, 95 per cent., refined bbl	Gal.	1.60
Alum, ammonia lump	100 Lbs.	$6.00—6.50
Aluminum Sulphate, high grade, bags	100 Lbs.	3.50—4.00
Ammonia, Aqua .880	Lb.	.16—.18
Ammonium Carbonate	Lb.	(Nominal)
Benzoic Acid	Lb.	5.50—6.00
Bleaching Powder, 35% drums	Lb.	.04—.05
Borax, crystals	Lb.	.10—.10¼
" powdered	Lb.	.10—.10½
Boric Acid, powdered	Lb.	.16½
Calcium Chloride, fused, in drums	Lb.	2½
Carbolic Acid, white crystals	Lb.	.60—.75
Carbon Bisulphide	Lb.	.25—.30
Casutic Soda, ground, Bbl.	Lb.	.08—.09
China Clay, imported	per ton	$25—$30
Chloroform, com	Lb.	1.00—1.40
Citric Acid, domestic, crystals	Lb.	1.05—1.10
Cobalt Oxide, black	Lb.	1.50—1.75
Copper Sulphate (Blue Vitriol)	Lb.	.11½—.12
Fuller's Earth, powdered	100 Lbs.	6.00
Glycerine, 56 lb. tin	Lb.	.76
Hydrochloric Acid, carboys, 180	Lb.	.03¼—.03½
Lead Acetate, white crystals	Lb.	.25
Lead Nitrate	Lb.	.18—.20
Magnesium Carbonate, B.P., bbl	Lb.	.22—.25
Nitric Acid, 36° carboys	100 Lbs.	.10
Oxalic Acid	Lb.	.49—.50
Potassium Bromide	Lb.	2.10—2.35
Potassium Carbonate 90 to 95%	Lb.	1.75—2.00
Potassium Chlorate, crystals, Kegs	Lb.	.55—.60
Potassium Nitrate, Kegs	(Nominal)	
Potassium Permanganate, bulk	Lb.	2.50—2.75
Salicylic Acid	Lb.	1.25—1.50
Silver Nitrate	Oz.	1.00—1.10
Soda Ash, bags	Lb.	.04—.05
Sodium Acetate	Lb.	.20—.22
Sodium Bicarbonate, 100% pure	100 Lbs.	4.00—4.50
Sodium Bichromate, bbls	Lb.	.28—.30
Sodium Cyanide, bulk, 98-99 per cent., in cases	Lb.	.38—.40
Sodium Hyposulphite, kegs	100 Lbs.	3.60—4.00
Sodium Nitrate, refined	100 Lbs.	9.00—10.00
Sodium Silicate, according to density	100 Lbs.	4.00—6.00
Sulphur, ground	100 Lbs.	3.00—3.25
Sulphur, roll	100 Lbs.	4.75—5.00
Sulphuric Acid, 66° Be, carboys	100 Lbs.	3.25—3.50
Tannic Acid, commercial	Lb.	.90—1.10
Tartaric Acid, crystals or powdered	Lb.	95—1.00
Tin Chloride, crystals	(Nominal)	
Zinc Sulphate, com	Lb.	.6½—.07

Metals

Aluminum, No. 1, 98-99%	Lb.	.40—.45
" Government price in 50 ton lots for ingot 90-99% A 1	Per ton	$6.60
Antimony	Lb.	.16—.18
Arsenic, white	Lb.	.15—.17
Brass, yellow ingots	Lb.	.20—.22
" red	Lb.	.25—.27
Cobalt, metal	Lb.	2.50—3.50
Chrome, 50% high grade	Per unit	$1.70
Cobalt oxide, grey	Lb.	1.65
Copper, casting	Lb.	.29
Copper, electrolytic	Lb.	.30
" Am. Government price (electrolytic and casting	Lb.	.26
Iron, bars	100 Lbs.	5.25
Lead	Lb.	.10—.10¼
Magnesium	Lb.	1.75—2.25
Mercury	Lb.	2.00—2.50
Nickel, electrolytic	Lb.	.40—.45
Platinum, pure	Oz.	105.00
Silver, bar (U. S. Govt. price)	Per troy oz.	1.01—
Spelter	Lb.	.10—.10½
Steel, mild	100 Lbs.	5.50
" nickel, in bars, 3½% Nickel	Lb.	.25—.27
" Sheet, Bessemer, 28 gauge	100 Lbs.	8.00—8.30
Tin	Lb.	1.00—1.05

BRITISH TRADE COMMISSIONERS AT THE CANADIAN EXHIBITION

The Department of Overseas Trade (Development and Intelligence) of the British Government, were represented at the Canadian National Exhibition at Toronto this year. Both Mr. G. T. Milne, H.M. Trade Commissioner at Montreal, and Mr. F. W. Field, H.M. Trade Commissioner at Toronto, were in attendance part of the time at the Bureau of Information, which was located in the Government Building at the Exhibition.

An explosion of unknown origin, took place in a freight car near the Central Station at Ottawa, last month, and destroyed or damaged 28 cars with a loss of $90,000.

Index to Advertisements

EMPLOYMENT DEPARTMENT

The charge for condensed advertisements of "Engagements Wanted," or "Positions Open," is 50 cents per month for advertisements of 40 words or less, no charge being made for the use of box numbers in care of CANADIAN CHEMICAL JOURNAL.

ENGAGEMENTS WANTED

Practical Metallurgist open for engagement, desires change, and would prefer position in any industrial laboratory, where ability, and ambition for promotion would be recognized. Box 21, CANADIAN CHEMICAL JOURNAL.

Chemist, familiar with gun-cotton, powder, TNT, nitric and sulphuric acids. Experienced in analysis of acids. Capable manager. Box 5, CANADIAN CHEMICAL JOURNAL.

A young engineering student desires a position in a chemical laboratory. Complete high school education as well as two years at Toronto University in the department of chemical engineering.—Box 16, CANADIAN CHEMICAL JOURNAL.

POSITIONS OPEN

Assistant Chemist wanted for large chemically controlled industry in Maritime Provinces. Salary $1,600. A University graduate, well trained, energetic and resourceful is desired. Previous industrial experience not essential. Apply Box 22, CANADIAN CHEMICAL JOURNAL.

Process Foreman in TNT Explosives or Acid manufacture who desires to connect with a related industry which manufactures a commercial product can communicate with Box 17, CANADIAN CHEMICAL JOURNAL.

Large chemical works requires the services of several chemical Foremen who offer experience in some branch of process work. Must be accustomed to handling men. Good prospects in a permanent industry. State salary wanted and particulars on work you have engaged in. Box 18, CANADIAN CHEMICAL JOURNAL.

MACHINERY WANTED

The advertiser wishes to get in touch with makers of plant for the production of Hydroflouric Acid. Address Box No. 1, CANADIAN CHEMICAL JOURNAL.

CLASSIFIED INDEX OF ADVERTISEMENTS

Acetone and Acetates—
Standard Chemical Co.

Acids—
C. W. Campbell
Dominion Tar and Chemical Co.
Lazard-Godchaux of Am., Inc.
Levinstein, Limited
Lymans, Limited
Mallinckrodt Chemical Works
Merck & Co.
McArthur, Irwin, Limited
National Drug & Chemical Co.
Nichols Chemical Co.
Standard Chemical Co.
The Topley Co.
U.S. Varnish Co.

Acid-Proof Paints —(See Paints)

Acid-Proof Apparatus—
Buffalo Foundry & Machine Co.
Maurice A. Knight
Luzerne Rubber Co.
Toronto Pottery Co.
U.S. Stoneware Co.
Valley Iron Works

Air Compressors—
Canadian Ingersoll Rand Co.

Alcohol, Wood—
Standard Chemical Co.

Alum—
C. W. Campbell
A. M. Huestis
Nichols Chemical Co., Ltd.

Apparatus—(See Laboratory)

Architects—
Samuel M. Green Co.

Arsenic—
Coniagas Reduction Co.
Deloro Smelting & Refining Co.

Autoclaves—
Buffalo Foundry & Machine Co.
Detroit Heating & Lighting Co.
Lymans, Limited
Scientific Materials Co.
Ernest Scott & Co.
The Topley Co.
Valley Iron Works

Babbitt Metal—
Canadian Fairbanks-Morse Co.

Barrels—
Smart-Turner Machine Co.

Balances—(See Laboratory Apparatus)

Bismuth, Metal and Salts—
Merck & Co.

Bleaching Powder—
C. W. Campbell.
Canadian Salt Co.
The Mendleson Corporation
Nichols Chemical Co., Ltd.
T. E. O'Reilly
T. D. Wardlaw
Wilson Paterson Co.

Bunsen Burners—
Detroit Heating & Lighting Co.

Carbide—
Canada Carbide Co.

Carbolic Acid—
F. E. Cornell & Co.

Centrifugal Extractors—
Tolhurst Machine Works

Caustic Soda—
C. W. Campbell
Canadian Salt Co.
Canadian Anilines & Chemicals, Ltd.
The Mendleson Corporation.
Merck & Co.
Nichols Chemical Co.
Wilson Paterson Co.
T. D. Wardlaw

Chemical Apparatus—(See Laboratory Apparatus and other headings)

Caustic Soda Plant—
Buffalo Foundry & Machine Co.
The Dorr Company
Samuel M. Green Co.

Charcoal—
Standard Chemical Co.

Chemical and Consulting Engineers—
Associated Geological Engineers
Buffalo Foundry & Machine Co.
J. T. Donald, & Co.
The Dorr Company
FitzGerald Laboratories
General Ceramics Co.
Gilbert Laboratories
Samuel M. Green Co.
James, Loudon and Hertzberg
Kalbperry Corporation
Palo Company
Process Engineers, Limited
Ruggles-Coles Engineering Co.
George Taylor Hardware, Ltd.
Stillwell Laboratories
Ernest Scott & Co.
Toronto Testing Laboratory
E. J. Young

Chlorine Plant—
Samuel M. Green Co.

Cobalt and Cobalt Oxides—
Coniagas Reduction Co.
Deloro Smelting & Refining
Keeling & Walker, Ltd.

Chemicals—
C. W. Campbell
Chalmers, R. S. & Co.
F. E. Cornell & Co.
Canadian Anilines & Chemicals, Ltd.
Dominion Tar & Chemical Co.
Geigy Company Inc.
The J. F. Hartz Co, Limited
Hellenic Chemical & Color Co.
A. M. Huestis
Keeling & Walker, Limited
Kalbfleisch Corporation.
Lazard-Godchaux of Am., Inc.
Levinstein, Limited
Lymans, Limited
Mallinckrodt Chemical Works.
The Mendleson Corporation
McArthur, Irwin, Ltd.
Merck & Co.
Monsanto Chemical Works
National Drug & Chemical Co.
Nichols Chemical Co.
T. E. O'Reilly
Palo Company
W. A. Pye Co.
Standard Chemical Co.
Wm. H. Scheel.
T. D. Wardlaw
Wilson Paterson Co.

Colors—(See Dyestuffs)

Condensers—
Buffalo Foundry & Machine Co.
Detroit Heating & Lighting Co.

Copper Coils—
Detroit Heating & Lighting Co.

Compressors—(See Air Compressors)

Drills, Rock—
Canadian Ingersoll-Rand Co.

Exposition—
National Exposition Chem. Industries
Ontario Bureau of Mines
Colonization, Mines & Fisheries, Quebec.

Drills, Twist—
Pratt & Whitney Co. of Canada

Disentegrators—
J. Harrison Carter, Ltd.

Drugs—
F. E. Cornell & Co.
Levinstein, Limited
Lymans, Limited
Mallinckrodt Chemical Works
Merck & Co.
Monsanto Chemical Works
National Drug & Chemical Co.
T. E. O'Reilly
Wm. H. Scheel

Drums—(See Barrels)

Dryers—
Buffalo Foundry & Machine Co.
J. Harrison Carter, Ltd.
General Ceramics Co.
Ruggles-Coles Engineering Co.
Ernest Scott & Co.

Dyestuffs—
C. W. Campbell
Canadian Anilines & Chemicals Ltd.
Chalmers, R. S. & Co.

CLASSIFIED INDEX OF ADVERTISEMENTS—*Continued*

Dyestuffs—
Geigy Company, Inc.
Hellenic Chemical & Color Co.
Levinstein, Limited
McArthur, Irwin, Ltd.
T. E. O'Reilly
Standard Chemical Co.
T. D. Wardlaw
Wilson, Paterson Co.

Electro Chemical Works—
Shawinigan Water & Power Co.

Electrical Apparatus—
Canadian Fairbanks-Morse Co.
Canadian General Electric Co.
Eimer & Amend
Samuel M. Green Co.
Nichols Chemical Co., Ltd.
Volta Manufacturing Co.

Enameled Steel Tanks and Apparatus
Dominion Iron & Wrecking Co.
The Pfaudler Co.

Engineers—(See Consulting Engineers)

Engines—
Canadian Fairbanks-Morse Co.

Evaporators—
Buffalo Foundry & Machine Co.
Dominion Iron & Wrecking Co.
Ernest Scott & Co.
Valley Iron Works

Extractors, Centrifugal—
Tolhurst Machine Works

Filter Paper—
H. Reeve Angel & Co.
A. Daigger & Co.
Eimer & Amend
The J. F. Hartz Co., Ltd.
Lymans, Limited
Palo Company
W. A. Pye Co.
Scientific Materials Co.
George Taylor Hardware, Ltd.
The Topley Co.

Filtering Equipment—
Buffalo Foundry & Machine Co.
United Filters Corp.
Herold China & Pottery Co.

Furnaces and Accessories—
Eimer & Amend
Samuel M. Green Co.
George Taylor Hardware, Ltd.
Scientific Materials Co.
Volta Manufacturing Co.

Gas Machines—
Detroit Heating & Lighting Co.

Geologists—
Associated Geological Engineers
Gilbert Laboratories
E. J. Young

Grinding Machines—
Canadian Fairbanks-Morse Co.
J. Harrison Carter, Ltd.
George Taylor Hardware, Ltd.

Glassware, Chemical—
A. Daigger & Co.
Eimer & Amend
Griebel Instrument Co.
The J. F. Hartz Co., Ltd.
Herold China & Pottery Co.
Lymans, Limited
Palo Company
W. A. Pye Co.
Scientific Materials Co.
The Topley Co.

Hydro-Electric Power—
Shawinigan Water & Power Co.

Iodine Preparations—
Merck & Co.

Iron & Steel Structural Work—
Dominion Iron & Wrecking Co.
Kalbperry Corporation

Kegs—(See Barrels)

Kettles—
Buffalo Foundry & Machine Co.
Detroit Heating & Lighting Co.
Pfaudler Co.

Laboratory Apparatus and Supplies—
H. Reeve Angel & Co.
A. Daigger & Co.
Detroit Heating & Lighting Co.
Eimer & Amend
Griebel Instrument Co.
The J. F. Hartz Co., Limited
Herold China & Pottery Co.
Lymans, Limited.
Palo Company
W. A. Pye Co.
George Taylor Hardware, Ltd.
Scientific Materials Co.
The Topley Co.
Valley Iron Works.

Machine Tools—
John Bertram & Sons Co., Limited
Pratt & Whitney Co. of Canada.

Magnesium—
Shawinigan Electro Metals Co.

Microscopes—
The J. F. Hartz Co., Limited
Lymans, Limited
The Topley Co.
W. A. Pye Co.

Mineral Exhibits—
Ontario Bureau of Mines

Monel Metal—
Bayonne Casting Co.

Nickel—
Bayonne Casting Co.
Coniagas Reduction Co.
Deloro Smelting & Refining Co.

Oils—
Canadian Anilines & Chemicals, Ltd.
Dominion Tar and Chemical Co.
National Drug & Chemical Co.
Standard Chemical Co.

Paints—
Hellenic Chemical & Color Co.
McArthur, Irwin, Ltd.
U.S. Varnish Co.

Patent Solicitors—
Hanbury A. Budden
Ridout & Maybee

Photometers—
Palo Company

Pipes and Fittings—
Buffalo Foundry & Machine Co.
Canadian-Fairbanks-Morse Co.
Luzerne Rubber Co.

Platinum Ware—
Eimer & Amend
Griebel Instrument Co.
Lymans, Limited.
Palo Company
Scientific Materials Co.
The Topley Co.

Photographic Chemicals—
Levinstein, Limited
Mallinckrodt Chemical Works
Merck & Co.
National Drug & Chemical Co.
Palo Company
The Topley Co.

Pumps—
Canadian Allis-Chalmers
Canadian Ingersoll-Rand Co.
Canadian Fairbanks-Morse Co.
Smart-Turner Machine Co.

Rails and Railway Supplies—
John J. Gartshore

Refiners—
Bayonne Casting Co.
Coniagas Reduction Co.
Delora Smelting & Refining Co.

Rhotanium—
Palo Company

Rubber Piping and Fittings—
Luzerne Rubber Co.

Saccharine—
F. E. Cornell & Co.

Screens—
Canada Wire & Iron Goods Co.

Stains—
The Dominion Tar & Chemical Co.
The J. F. Hartz Co., Limited
National Drug & Chemical Co.
The Topley Co.

Steam Turbines—
Canadian General Electric Co.

Stills—
Detroit Heating & Lighting Co.
Eimer & Amend
W. A. Pye Co.

Stoneware, Chemical—
General Ceramics Co.
Maurice A. Knight
U.S. Stoneware Co.
Toronto Pottery Co.

Sulphur—
Nichols Chemical Co.
Union Sulphur Co.

Tanks and Tank Equipment—
Baltimore Cooperage Co.
Dominion Iron & Wrecking Co.
The Pfaudler Co.
Goold, Shapley & Muir Co., Limited
Kalbperry Corporation

Tanning Extracts—
McArthur, Irwin, Ltd.

Tar—
Dominion Tar & Chemical Co.

Tools, Small—
Pratt & Whitney Co. of Canada

Towers, Concentrating—
Baltimore Cooperage Co.
Kalbperry Corporation

Turpentine—
Brown Corporation

Valves—
Canadian Fairbanks-Morse Co.

Varnishes—
Dominion Tar & Chemical Co.
McArthur, Irwin, Ltd.
U.S. Varnish Co.

Wood Tanks—(See Tanks)

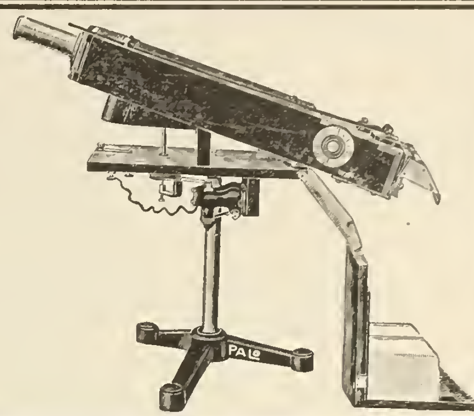
Wood Preservatives—
Dominion Tar & Chemical Co.

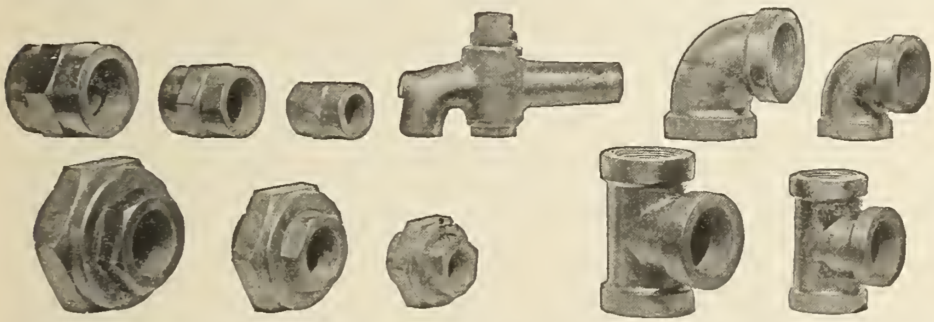
Wire Cloth—
Canada Wire & Iron Goods Co.

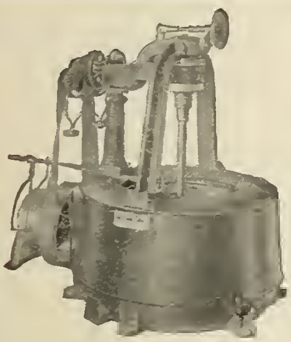
Water Power—
Shawinigan Water & Power Co.

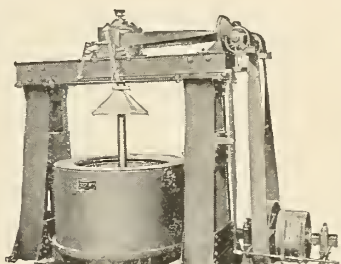
Water Towers and Supplies—
Baltimore Cooperage Co.

Zinc Products—
Keeling & Walker, Limited
Metals Disintegrating Co.


PALO







"SCIMATCO"

EXPERIENCE AND SERVICE

EXTENDED TO ALL

CHEMISTS AND METALLURGISTS

"SCIMATCO" EXPERIENCE is gained through close personal touch with many leading industrial chemists.

"SCIMATCO" SERVICE is a real service, embracing—Highest Quality—Fair Prices—Immediate Deliveries.

Scientific Materials Co.

Pittsburgh, Pa.

"EVERYTHING FOR THE LABORATORY"

CANADIAN CHEMICAL JOURNAL

A Canadian Journal devoted to Metallurgy
Electro-Chemistry and Industrial Chemistry.

Vol. II, No. 10 TORONTO, OCTOBER, 1918 20c. a copy; $2 a year

PROFESSIONAL DIRECTORY

CANADIAN
CHEMICAL JOURNAL
A Canadian Journal devoted to Metallurgy
Electro-Chemistry and Industrial Chemistry.

Vol. 2 | TORONTO, OCTOBER, 1918 | No. 10

Canadian Chemical Journal
Devoted to the Chemical and Metallurgical Interests of Canada

Published monthly by the Biggar Press Limited
540-541 Confederation Life Bldg. - Toronto, Canada

E. B. BIGGAR, Managing Director
L. E. WESTMAN, M.A., Editor
Telephone Main 7399

Subscription price, $2, per year to Canada, United States and all parts of the British Empire; Foreign countries, $2.50 per year.

Time of going to press, 1st of each month. News and changes of advertisements should be in hand one week before.

CONTENTS

THE Fourth National Exposition of Chemical Industries at New York last month, proved to be a great success, particularly in the feature of attendance. More than at any previous exhibition, those who came were chemists, metallurgists, or men interested in chemical industries, while at the earlier shows most of the visitors were of the public at large, who came to see what Uncle Sam was setting out to do in a new field of manufacturing. At the present show, exhibitors were requested to put the symbol of a printed "bulls eye" on each article made during the present year for the first time in the United States. This sign was found affixed to about 300 articles on exhibition. If we allow for duplications, due to the fact that in many cases the same new line of chemicals would be made by more than one competing firm, there would still be at least a hundred new chemical products made for the first time in America. This measures a most creditable advance in the chemical and allied industries. As the Grand Central Palace has now been taken over by the U. S. Government as a base hospital, it has been decided to hold the next exposition at Chicago in the Coliseum, the largest exhibition building in that city. Already over two-thirds of the space has been applied for, and the enterprising people of the West and Middle West will, no doubt, strive to make the show—which is fixed for the week beginning September 22nd—the best ever held.

DR. A. McGILL, of Department of Trade and Commerce, Ottawa, has very kindly set down an account of his observations at the recent meeting of the American Chemical Society at Cleveland, and also the Convention of Food Officials held in Chicago last month. An account of the Fall meeting of the American Electro chemical Society should be of special interest to Canadians, as this branch of the work constitutes one of our largest possible fields. The Exposition of Chemical Industries in New York disclosing as it did all the recent industrial advances in machinery, the discovery and use of new products, dyes, chemicals, etc., should react as a stimulant to

greater effort on the part of Canada towards the more direct utilization of her wonderful natural resources along so many lines. Yours is the field, and now is the opportune time.

THE ALUMINUM OCTOPUS

ON the ground that the aluminum it intended to manufacture for the Northern Aluminum Co., was a war necessity, the St. Lawrence Power Co., which applied for power rights at the Long Sault, in the St. Lawrence River, was allowed to construct a power development for the period of the war, and a limited time afterwards. The authority was given by the International Waterways Commission, to whom the Governments of the United States and Canada referred the application. And now, on the heels of this application, comes another from the New York and Ontario Power Co., for the right to build a dam at Waddington, on the same river. The first application, even though for temporary rights, should not have been granted. Seeing that navigation would be seriously affected, and that power can be had ready to harness elsewhere in Quebec, the second application should not be entertained for a moment.

BENZENE NOT BENZOL

A MOVEMENT is under way in the United States to discontinue the use of the term "benzol." It would appear that the English word "benzene" has a much better claim for consideration by all chemists. It is simply another case where an Englishman made a discovery which was afterwards thoroughly Germanized. The ending "ol" is quite misleading and not in harmony with the significance of general organic nomenclature. Any move in this direction should receive hearty support from all those who love the English language and who wish to retain priority rights in this connection.

POTASH FRAUDS

IT is nearly time that some Dominion authority should investigate with the view of bringing smartly to order those people who insist on starting a "potash rush" every little while. The search for commercially valuable sources of potassium should of course be stimulated, but the advertising of absolutely false and misleading announcements of its discovery should not go on unnoticed. These newspaper reports may be utterly demolished by investigation, but at the same time the original announcements may be used in clever hands in connection with stock selling swindles of the worst kind. Provincial and Dominion Governments should take every opportunity to thoroughly investigate the proposals of all corporations gathering funds from the public for the purpose of developing feldspar and potash deposits. Canada should not allow her good name to be bandied around in this way, as the net result of such exploitation is to frighten off really valuable backers of the country's natural resources.

WAR SERVICE OF CANADIAN CHEMISTS

AT first sight it would appear that Canadian Military Authorities underestimated greatly the possibilities that might accrue from a more direct and complete organization of Canadian chemists as a regular branch of our established forces. Color would seem to be added to this conception from the wonderful organization which has been started in connection with the Chemical Warfare Service Section of the United States Army. As no call for such direct military service has ever been made to Canadian chemists it is more than probably that quite a number of them may feel that they have not been given a wide enough opportunity to show what they could do.

Two quite distinct systems are being operated by the Allies in conducting this war as far as non-fighting units and the production of the necessary ordnance supplies are concerned. One system would throw into uniform and place under military supervision those men who carry on and direct the manufacture of metaliferous and chemical, gas supplies, and the necessary research work which the ever speeding pace demands. This, in general, is the French and American conception of the best way of accomplishing the desired end. The other system consists in establishing a non-military ministry of munitions to handle the work, and making much less effort in the direction of expanding the established ordnance branch of the regular pre-war army. As this is the British system, we in Canada have naturally become a part of it.

At the outbreak of the war the French Army was in a better position to carry on along its old established lines. The British system of building up civilian organizations was the only way that the British forces could hope to meet the onrush of the enemy in time to be of any value. That flood was met by such effort, and now the machine is working so effectively both here and in other parts of the Empire, that it is not likely our military authorities will ever consider taking over this work and binding it up under the non-flexible bonds of military methods. With more time at their disposal, broader preparation previous to initial effort was possible in the United States.

It should be clearly understood also that we are not in the best position here to follow the lead of our American Allies in the production of large quantities of supplies for gas warfare. They may be said to be specializing in this branch of the work, and are in the best position to relieve the French and British Governments in this connection. This kind of warfare is even yet relatively new, and demands the creation of original machinery of war. In particular,

enormous quantities of chlorine must be produced as a basic material.

The method of accomplishing this work as outlined recently in American publications calls for a very large and broad military organization with chemists in uniform, embracing all ranks. This certainly does raise the status of the American chemist in the public conception, and recognizes in a way that cannot be mistaken, the value of chemistry when directly applied to winning the war. It is breaking farther away from the older idea that a soldier must be a member of an actual fighting unit. Whether or not this method tends to more general efficiency than that obtainable from a civilian organization of chemists carrying on the same work, is questionable. A very small percentage of these men are expected to see service in France. Those who do when properly trained, should make very good instructors and officers in special lines, and it is very unfortunate that our militia authorities have never yet seen their way clear to give even a few Canadian chemists such opportunities of making good at the front with our forces.

The truth of the whole matter is that we have not enough chemists in the country to begin to look after our munition plants and industries properly now. We could therefore allow only a very few to enter special work abroad without actually stopping production at home. The Canadian chemist should obtain this conception clearly before allowing himself to be carried away by the enormous organization which is at present attempting to carry on the chemical warfare work of the United States forces. Our military authorities have always recognized the value of the chemist from every point of view. There has been a very fine combing of Canadian forces for men with chemical training and experience. This has been going on without much advertising. These men have not been given commissions, but they have been returned to needy industries, or have been given positions in plants working on war materials of all kinds. Research work has been carried on of the greatest importance and value, under the civilian direction of our Ministry of Munitions and in our university laboratories. Had every chemist rushed madly to Ottawa; had he been given a uniform, the next result would have been that an industry or university would have lost a very good man, and the army would have been cluttered up with more questionable organization. To get the same net result this involves more time. There are, and have been, special cases where the British system has employed chemists as officers while carrying on chemical work, but there is not likely to be any sudden increase in the number of these appointments.

Those men, however, who are now working as chemists in munition plants or are otherwise exempted from military service because of their special qualifications as chemists should be given some special visible recognition by the Militia Department even at this late date. If this were done, they could continue in their service to the country with more contented minds, and receive as individuals more public regard than they do at the present time. In this matter in particular, the American authorities have shown the way.

THE second instalment of the article by Mr. Francis A. J. FitzGerald, on "Canada and Electro-Chemistry" will appear in next issue.

CHICAGO AND CLEVELAND CONVENTIONS

Ottawa, 30th September, 1918.

The Editor, Canadian Chemical Journal,
Toronto.

Dear Sir,—

I have pleasure in acceding to your request for a brief account of impressions received on my recent visits to Chicago and Cleveland in connection with the Conventions of Dairy, Food and Drug Commissioners and the American Chemical Society respectively.

It is very generally known that, while Federal Standards for foods, etc., in the United States, have been promulgated since 1906, the individual States of the Union possess, for the most part, their own standards, which frequently conflict with each other and with the federal standards; these last having force only in the District of Columbia, and in interstate commerce. Consequent upon the divergencies implied, much confusion has resulted, and manufacturers of commodities which have wide distribution, have been compelled to work in conformity with the regulations obtaining in each particular district to which their goods were consigned. Attempts have been made, in a more or less sporadic way, to bring about co-ordination between Federal and State rulings; and many State Acts have been modified so as to be practically identical, in their requirements, to Federal standards. The completion of this task is one of the chief aims of the Association; which is composed of the men who, as State Food Commissioners, and others charged with administration of the different Food and Drug Acts, control food problems; and the meeting at Chicago has especially in view the organizing of a responsible body to deal with this, and kindred subjects. It is of interest and importance to us to know that the Association in question is international, in so far that Canada is included, and Canadian food officials are eligible to membership. The boundary line between our country and the United States has no existence, and should have no existence, so far as quality of food is concerned; and as we have the same language, the terms used in defining foods should possess the same significance. Many important aspects of the matter were ably discussed, and the record of the deliberations will be published in due course.

The annual gathering of the American Chemical Society at Cleveland was well attended, if we regard actual numbers present; but many chemists who habitually attend these yearly meetings were prevented through the commanding urgency of the various manufacturing concerns with which they are connected. This, of course, due to the fact of the country being engaged in war. I was almost the only Canadian present; and this must be accounted for, by the same fact, for a large number of Canadians are members of the American Chemical Society.

There is to me a certain element of pathos felt at every successive annual meeting of this Society, with which I have been connected for more than a quarter of a century. The men whom I learned to know best have largely, during these years,

been gathered over to the great majority, or have, through age, been compelled to discontinue active work.

Many of those referred to have left behind them honourable and enduring reputations, and all have left an influence upon the society which must and does prove an inspiration to its present membership. At every new gathering, I note a growing preponderance of young men; full of promise for the continued and increased success of chemistry on this continent; and it was very pleasing and hopeful, to see among them a very considerable Japanese contingent, destined ultimately, no doubt, to carry the influence of the society to our ambitious allies in Asia.

The word "Allies" reminds me of the magnificent spirit of conquest which was in evidence both at this meeting, and at the convention in Chicago. To one whose heart is in sympathy with the triumph of democracy and humanity over militarism and cruelty, it was unspeakably delightful and encouraging to find such enthusiasm as I found everywhere. There can be no question of the ultimate triumph of right, backed by such irresistible force and such indomitable will to conquer. When a strong man is at the same time gentle and chivalrous, we have the best type that humanity has yet evolved; and it is impossible to believe that a nation exhibiting these qualities, can ever be other than victorious. The tributes paid to the heroism and achievements of our Canadian forces, were such as to quicken the pulse and make one feel both proud and grateful.

Among other diversions provided by our hosts at Chicago, was a visit to the Great Lakes Naval Training Camp some 40 miles from the city. At this camp, 47,000 blue-jackets are in course of training; and 22,000 were in review, headed by a magnificent group of military bands, led by Philip Sousa. As regiment after regiment passed by, there was no need to ask for salutation of the flag by the multitude of visitors; everyone felt that Old Glory symbolized the world peace and the triumph of humanitarianism at its best, which are surely coming. What is implied by millions of men in arms, could be faintly realized by the impression created on seeing 22,000 men, marching in step, and carrying out extensive manoeuvres, with perfect precision at the word of command. And the thought that all this is not for the purpose of brutal conquest, or the subjugation of smaller and weaker peoples, but for the punishment of a heartless bully, and the restitution of their national rights to his victims, is such as to create a thrill in the onlooker, and make him wish that he too might have a hand in the affair.

At the various sectional meetings of the Chemical Society, many very important subjects were discussed; and the papers read will, of course, appear in the technical journals published by the Society. It is scarcely necessary to say that nearly every topic was treated as having regard to its bearing upon the problem of war.

Serious illness prevented the President, Dr. W. Nichols, from being present; but his address was read, and proved to be a highly interesting account of the growth of the Society from small beginnings, to a present membership of over 12,000; and the parallel development of applied chemistry in American manufacture. So far from the chemist having to apologize for his interference, it has come about that no industry of importance can afford to dispense with his services. Mere increase in membership has a value of its own; and the publications of the Society are of such a character as to be indispensable in every laboratory.

Among other applications of chemistry to world problems, the scientific treatment of sewage is receiving much attention at Cleveland; and I was particularly interested in an afternoon visit to the sewage disposal works, situated some eleven miles from the heart of the city. The problem of rendering water-carried sewage harmless and inoffensive, is one which grows in intensity and importance with the growth of great centres of population. Whether or not it may ever be possible to utilize the fertilizing or other values contained in water-borne sewage, and thus create an offset to the cost of treatment, is a question of great importance; and it is being attacked in a serious manner, and with large expenditure, in Cleveland.

I have perhaps written at sufficient length to convince you of the importance of these associations and the great pleasure derived from connection with them. Not the least, is the hopefulness and confidence inspired by personal contact with the leaders of chemical thought and work on this continent.

A. McGill.

DEVELOPMENTS IN CERAMICS*

By A. V. Bleininger

One of the most important functions of the ceramic industries is the supply of refractories for the metallurgical operations of the country, steam power-plants, by-product coke oven, gas plants, glass works, and many other purposes too numerous to enumerate here. The demand for these products has been enormous and has been met by the refractories industries in a very satisfactory manner. Although at times the need of No. 1 fire-bricks has been greater than the production, such a condition does not exist at the present time, owing to the expansion of this branch of the industry. In many instances the extraordinary demand was caused in part by the unwillingness of consumers to use anything but No. 1 refractories even for purposes where lower-grade products would serve equally well. Fire-bricks of the lower refractory grades are available in abundance, especially since a considerable number of face and building-brick plants have taken up the production of this type of ware. One of the urgent needs in this connection is the establishment of a classification and specification of the several grades of clay refractories. This task is being undertaken at the present time by the War Industries Board. The work of standardizing the shapes of fire-brick has already been accomplished in a satisfactory manner.

Coke Ovens Increase Demand for Silica Brick

The demand for silica bricks has been greatly increased through the development of the by-product coke oven. Meeting this demand involves not only large quantity production of these refractories, but high quality as well. It is necessary that the transformation of the quartz to cristobalite be largely completed as indicated by the lowering of the specific gravity to a value of not more than 2.38 and that the product possess good mechanical strength, corresponding to an average modulus of rupture of about 500 pounds per square inch. These requirements are exacting and may not always be met in bricks made from silica rock other than quartzite. Certain materials, like chert and flint, transform to cristobalite more rapidly than quartzite, but do not yield as strong a product. Sandstones usually transform more slowly and likewise tend to give inferior strength.

The manufacture of silica refractories is certain to expand still more, both in the eastern states and in the middle west. If the war continues for any considerable period, additional emergency production in connection with the erection of new coke-oven plants will certainly be necessary.

Difficulties have been met in supplying the basic magnesite refractories from the available American materials. This has been due to the nature of our magnesite, which differs from the Austrian ore in being very low in iron oxide and sometimes higher in lime. This makes it necessary to add the iron synthetically, a procedure which adds to the cost of production since it requires intimate blending and grinding of the mixture and a higher calcination temperature than is needed with the European raw material. In addition the magnesite must be transported across the continent from California or Washington. The latter state produces at the present time large quantities of magnesite quite low in lime and the quality of the material is of a character which is making it possible to reduce operations to a uniform practice.

It has been found possible also to replace magnesite bricks

*By permission of the U.S. Bureau of Standards.

in certain operations by bauxite refractories. The production of magnesia spinal refractories of the composition $MgO.Al_2O_3$ has made a beginning and it is not unlikely that for many purposes it will prove a very desirable material. There has naturally been a shortage of chromite refractories, even though the quantities really needed are small. This has been overcome by the use of thinner partings and in many cases by doing away with this refractory entirely without apparently any serious effects.

Superiority of Ceylon Graphite

Much has been said on the question of graphite crucibles. The graphite problem is undoubtedly the more important one in this connection. It is a difficult matter to replace Ceylon graphite altogether with the domestic mineral. In the first place the greater density of the imported material, 2.25, which imparts to it the characteristic resistance to oxidation, its foliated structure, and the low ash content of the best grades combine to make it extremely satisfactory for the purpose of crucible making. This graphite can be bonded together with a comparatively small amount of clay, since the surface factor per unit weight is smaller than for that of any other kind of graphite.

This point may be illustrated by the volumes occupied by the same weight of several types of graphite. Thus, 100 grams of ground Ceylon graphite after thorough shaking occupies a volume of 90.7 c.c., Canadian graphite 119.6 c.c., and Alabama graphite 152.0 c.c. In other words, it would be impossible to make graphite mixtures of maximum carbon content from the two American materials. Since they offer a much larger surface the amount of clay used must be greater. From this it follows that the ultimate density and thermal conductivity are certain to be lower.

To what extent American flake graphite can be admixed with the Ceylon graphite remains to be seen. The writer has seen mixtures in which the flake added amounted to 20 per cent. of the total graphite content and gave fair foundry results. It might be possible, however, to perfect processes which will enable the crucible maker to employ larger percentages of domestic graphite, and at the same time secure practically the same results as with Ceylon graphite. On the other hand, there is no reason why a large quantity of domestic graphite should not be used in the making of stoppers and similar articles. The comparison made between the Ceylon and flake graphite is, of course, relative, and refers to crucible value obtained per dollar at the present time. If for some reason this country could no longer obtain Ceylon graphite, the production of metal certainly would not be diminished in any way, as we could get along very well with flake and amphorous graphite, furnace carbon, and coke.

German Clays Successfully Replaced

The lack of the German Klingenberg clay for crucible making is not as serious a matter as has been thought. It has been shown conclusively that it can be replaced both by English and American ball clays.

Similarly, the German Gross Almerode clay used in the making of glass pots, has been replaced by American clays and synthetic mixtures in a very satisfactory manner. In fact, it is quite probable that the new techniques now being developed will yield results superior to those formerly obtained with the use of imported clay. The shaking up caused by the war will, in the end, be of distinct service to the glass refractories industry. At the same time, the glass industry will gain in pot service through the realization that the control of the heating up process of the pots in the arches is essential in preventing loss.

Special clay refractories have been developed also with reference to improved thermal insulation, including materials highly refractory, light in weight, and possessed of good insulating qualities. The saving in fuel consumption and weight through the use of such products is bound to be considerable.

Development of Porcelain Industry a National Duty

The manufacture of hard-fire, true porcelain has received a powerful impetus through the war. Three plants are already operating successfully on the production of chemical porcelain, and are making rapid strides with respect to quality. The manufacture on a large scale of hard porcelain tableware is to be begun in the very near future. It is very fortunate that the pioneers in this work have realized the importance of putting their production on a firm basis with reference to foreign competition. By the use of automatic machinery, mechanical dryers and tunnel kilns, they will be enabled to meet foreign competitors on equal terms. The plants now in course of construction excel all European potteries in the elimination of unnecessary labor cost, and expenditure of fuel. The development of a hard-fire porcelain industry is, indeed, a national duty. It would be preposterous and humiliating to contemplate any further dependence on Germany and Austria for these products. By establishing this industry we shall be in position to seek the South American markets to which we have a fair right.

The demand for ordinary tableware at the present time is greater than has ever been known before and difficulty is being experienced in supplying the requirements of the Army and Navy, and at the same time those of the country. The simpler shapes, such as cups and mugs are now being produced by the one-fire process, which incidentally results in an appreciable saving of fuel.

New Porcelains Show High Electrical Resistance

Porcelains for special purposes have been developed successfully. Thus, the national Bureau of Standards has introduced the manufacture of the refractory Marquardt porcelain, essentially sillimanite, formerly produced by the Royal Porcelain Manufactory at Berlin and used so largely for pyrometer tubes and similar articles. Likewise, we have succeeded in making porcelains possessing remarkably high electrical resistance at elevated temperatures. Several of the bodies produced in the Pittsburgh Laboratory of the Bureau of Standards showed a resistance of one megohm per cubic centimeter at 780 deg. C. and at the same time a coefficient of thermal expansion of only 3.81 x 10.6 per deg. C. between the temperature range of 30 to 400 deg. C.

The same materials showed none of the variations in thermal expansion common to most porcelains, the coefficient remaining practically constant throughout the range of 30 to 520 deg. C. It is evident that such properties, coupled with good mechanical strength, are essential for such uses as aeroplane spark plugs. There is every reason to believe that the principles thus worked out will greatly assist in producing special grades of electrical porcelain for use under severe conditions. These developments have been assisted greatly through the use of the petrographic microscope in the study of porcelain structures.

Further Developments in Porcelain Expected

The manufacture of electrical porcelain is undergoing improvements at a more rapid rate than ever before in the history of this particular industry. The methods of preparation are more thorough, the details of shaping are being studied more carefully, the drying process is being controlled with greater accuracy, and the methods of testing developed toward more exact differentiation as to quality. The casting process is finding application to an increasing extent. Further developments are to be expected with reference to the composition and firing of electrical porcelain, based on more recent studies on the subject of the function of feldspar as an electrolyte and the volume changes induced by the transformtaion of quartz to its several crystalline modifications.

Considerable work is being done also with regard to the complete survey of the resources of the country in kaolins and ball clays for use in the ceramic and paper industries, through the agencies of the Association of State Geologists, the Bureau of Mines, the U. S. Geological Survey, the American Ceramic Society, and the Bureau of Standards. It is believed that this survey will enable us to take stock of our resources with the

final object of making ourselves independent of any foreign sources. A considerable number of new clay deposits have been located within the past two years, to say nothing of glass, sand and other ceramic raw materials.

Chemical Stoneware Industry of Vital Importance

One of the clay industries vital in the prosecution of the war is the manufacture of chemical stoneware. The production of this type of ware requires particular skill, owing to the complicated designs, large size and the necessity of the tight fitting of the pieces. But few realize the magnitude of the task which confronted this industry, especially when handicapped by shortage in labor, fuel and other necessities. It is very gratifying, indeed, to be able to say that the stoneware manufacturers have met the situation so well and have been able to supply the needs of the chemical industries. This statement applies equally to the manufacturers of acid-proof enameled cast-iron and sheet-steel products which have played an important role in recent chemical developments.

Another industry having a direct bearing upon war work is that engaged in the manufacture of abrasives and grinding wheels. The rapid growth of this branch of manufacture and its technical development are characteristic of America. Its work has been done with such quiet efficiency and it has met the demands of the present conditions so promptly that but few realize the magnitude and importance of its accomplishments. Research has played a large part in this development and to the utilization of scientific facts we owe the highly specialized grinding tools made available for large production, as well as for the most delicate processes, such as the grinding of optical lenses.

The industries engaged in the production of ceramic structural materials have naturally been hard hit by the decrease in building activities and by the fuel orders. The manufacturers of building bricks, hollow tiles, sewer pipe, paving bricks, terra cotta, floor and wall tile, etc., are endeavoring to hold together their organizations. In districts where war activity prevails the plants are operating to capacity; in others new branches of manufacture have been taken up, such as the production of refractories, crucibles, and certain specialities for war use. But even under such conditions interesting developments are taking place. Much attention is being given to the question of fuel economy through more rapid firing and the utilization of waste heat. New applications of clay are being found such as the use of crushed vesicular vitrified brick material as an aggregate for concrete, having the advantage of light weight, low thermal conductivity, and constancy of volume when heated.

Optical, Signal and Chemical Glassware

With reference to the glass industry the three most interesting developments are those relating to the optical, colored (signal), and the resistant or chemical glasses. When it is realized that at the beginning of the war but little optical glass was being produced in the United States, the rapid development of the art presents an inspiring example. The necessity of war brought together the manufacturers on the one hand and scientific and technical organizations like the Geophysical Laboratory of the Carnegie Institute and the Bureau of Standards on the other.

Although some of the manufacturers had brought their furnace practice to a very satisfactory state it was not realized fully that the raw materials must be practically free from iron, sulphur, chlorine, and other impurities. Likewise, methods for the rapid examination of the glass were lacking so the frequently poor glass was brought to the grinding and polishing rooms of the optical shops; very often, too, good product was by chance rejected. The necessity of temperature measurement and control was not fully realized and the method of stirring had not been brought to a satisfactory development. At the same time the commercial glass pots were the source of much grief due to their high iron content, which discolored the glass in the absence of decolorizers which are not allowable and their failure to resist the corrosive action of the flint and barium glasses. These things have been overcome to a very large extent.

Rapid Progress in Producing Good Glass

Through the use of sand of great purity and constant checking of the composition of the other constituents, the primary difficulties have been removed. The composition of the glasses has been correlated with the optical properties, the index of refraction, the dispersion value, and the light absorption. Time-temperature schedules have been worked out for the melting and cooling periods and satisfactory stirring machines designed. Rapid inspection even of the glass in lump form is now possible by the use of immersion methods and examination with mono-chromatic light in addition to the examination through the polished edges of blocks.

The pot problem has been solved through the use of white burning clays like the kaolins and even more satisfactorily by the production of semi or true porcelain pots. Containers of the latter type are now being made in several works and have proved eminently useful. In fact, it has been possible to melt in such pots dense barium crown glasses which have proved exceedingly destructive to the ordinary types of refractory materials.

Essentials of Optical Glass Manufacture Mastered

The annealing process is being studied by a number of workers, and some interesting information has already been obtained. It might be said then that in the United States we have mastered the essentials of the production of optical glass, and about seven types are being manufactured commercially. Problems dealing with the cutting down of the losses of certain optical phenomena, etc., of course, still remain; it is to be expected that continued progress will be made in this art.

It is a source of pleasure to note also the fact that scientific and technical researches dealing with the technology of silicates are being continued at the present time, even though they have more or less bearing upon conditions brought about by the war. We are mastering more and more the control of the class of dispersed systems represented by clays floated in water, their drying behavior, and the changes which they undergo upon vitrification and fusion by resorting to the methods of the scientific investigator.

In this brief survey it has not been possible to emphasize some of the more important technical advances, nor was it permissible at this time to dwell upon certain developments, such as a new role played by clay in chemistry, but it is hoped that this hasty contribution might afford some conception as to the activities in the ceramic industries.

INDUSTRIAL CHEMISTS

At a recent meeting of the London Section of the National Association of Industrial Chemists, the President, Mr. A. C. J. Charlier, announced that eight local sections had been formed with a total strength of over 800. Excellent progress has been made at Manchester, Birmingham and Sheffield, where practical trades classes had been arranged for. In response to official inquiries, the Association had been able to secure valuable appointments for some of its members.—Journal of Soc. of Chemical Industry.

EXPLOSION AT TRENTON, ONT.

A fire, followed by a series of explosions, occurred at the plant of the British Explosives, Ltd., Trenton, Ont., Oct. 14. The loss of life was very limited, while considerable damage was done to property. The T.N.T. and gun cotton plants were destroyed. While it is most gratifying to know that all but a few employees escaped without any injuries, it must be remembered that the suspension of work for even a short time in such a large plant is quite a serious loss. It is expected, however, that new machinery and plant will be made available in a very short time.

RELATION OF RESEARCH TO INDUSTRY

(Continued from September Issue.)

Dr. Goodwin—Now, we have a more or less efficient staff of scientific men, more or less handicapped by conditions there, but properly posted. You have there exactly what has been described, a group of men dealing with different subjects. There is no research of any importance carried through without bringing in more than one side, and you have in the Universities a collection of investigators who should be the cream of the land, scientifically, and there researches of the most complicated sort might be adopted with the very best possible hope of a solution, bringing to bear upon them the whole force of the University staff. It seems to me that one ought to consider that feature of the situation very, very carefully before we are committed to the ideas put forward. I say this with a good deal of confidence too, Mr. Chairman, for I am in full sympathy with the idea of establishing something in the way of a co-ordinating scientific bureau to promote all this, but I would lay stress upon the co-ordination of that promotion, and would be very loath to do what I would consider to be destroying very largely the opportunity for advancing research in the Universities of the country. If we enquire into the details, ask ourselves what research is—the attempt to advance knowledge—and then enquire what the process of cultivating the spirit for this is; where there is the best opportunity for selection; where there is the best opportunity for cultivating the spirit. I think it goes without argument that the best opportunity for both these things is to be found where you have this large, more or less hand-picked class of young men in the Universities, some of whom are born researchers, and unless there is in the University the opportunity for fuller development of the spirit and atmosphere of research, it will die out in the country. I am sorry to say it is not as strong as it ought to be. Unless there is that, we lose the chance of this selection and stimulation. I have no doubt in such a case, with the lack of this atmosphere, many a young man who had the germ in him, would go through the University, pass out and go into some humdrum existence where his natural aptitude for research would find no outlet. I think we should be most careful about failing to take this chance.

Dr. A. McGill—To develop industrial research in Canda, we must obtain real interest on the part of the manufacturers themselves. I am going to take the liberty of suggesting that Dr. Macallum become the author of a book. I know that he is an author already, but I wanted to suggest he write a book that shall be easily read by the labourer. A book that shall appeal to the manufacturer and to everyone financially interested in manufacturing operations. The industry which imagines it is going to be carried on for all time successfully along the lines of the present day is certainly making a tremendous faux pas. We must get them to feel that they must progress if they would hold the field that they now cover, and it seems to me that it might best be done by writing in popular fashion to a great many industries. In the old days we had the charcoal burners. The charcoal burner destroyed wood for the purpose of securing charcoal. He continued to make a very good living in the old fashioned way. The man who tried to destroy wood for the purpose of making charcoal to-day would find himself badly handicapped. As soon as it was found out that the by-products of that industry were really capable of sustaining the industry, other products, such as acetic acid, methyl alcohol and tar oils were collected, and their value paid for the charcoal. The higher alcohols, by-products of the rectification of alcohol, which were thrown down the drain, and which are now recovered, may be sold at a profit. To-day there is a demand for the production of ethers, which constitute a very valuable by-product in the rectification of alcohol. Time was when, not only in the case of the cane sugar sap, but in the case of the beet, mixed quantities of what are now found to be recoverable sugars, were regarded as waste. Now not only is the molasses used, but by improved methods more sugar can be obtained from the syrup. A part of the mother used, for even invert sugars, is found to be valuable as cattle food, and for other purposes. Illustrations multiply to the extent of hundreds. I would suggest that if a little brochure were uttered by this Council and popularly written, it would strike fire somewhere. It would emphasize the fact, in order that if an industry live, it must progress. It must take advantage of the utilization of things which at the present day are wasted. The public doesn't know it, or if they do it is only in a vague way. They do appreciate that the thing of greatest importance to mankind, is increased knowledge. We must have something definite in the hands of the unthinking public; something interesting so as to touch everybody's actual operations.

Dr. Ellis (Professor of Applied Chemistry, University of Toronto)—The relation of the university to research is one of great interest to those connected with the universities. It is needful to correct the attitude of the public towards the Universities. The function of the university is to train the people who are to prosecute researches, and for that purpose the university must first of all give to the young men that come under their care a sound education in the principles of science with relation to their application. It is complained that the universities in this country have been at fault because they are not sufficiently in touch with the world and with the industries, but the particular functions of the university can only be properly performed in more or less the attitude which is sometimes slightingly described as cloistered. A man cannot undertake the researches on fundamental matters connected with science, if his mind is taken up with the application of things about him.

There is certainly a considerable amount of work to be done on the part of the education of youth that is incompatible with the noise of the streets, and the first function of the university, it appears to me, is to produce men who can think about the problems which lie at the foundation of the progress of the world, ascertain what problems are unsolved, and consider how these problems may be solved. Therefore, in the first place, the country should place it within the power of the university to select the best men, no matter where or how they can be obtained, to fill these positions. They should be able to offer inducements which will attract the best men to the university chairs, and they should be able to give the men who occupy these chairs every assistance in equipment and in carrying on their duties as teachers. But with regard to research, it is above all necessary that there should be among these men those who not only have the knowledge, but the spirit of research. Therefore, the universities should be able to select such men as their professors, but the professor requires sympathetic students. He requires students who will be willing to follow in his lead, and he must be able to sct before them some goal which they may hope to attain, and one of these goals is the position of an investigator in either some great industry or in a university laboratory, or in a laboratory such as you have sketched. Now, the great difficulty with a university teacher is to select young men and induce them to take up the lines which he may suggest to them to complete his scientific training, and the two goals at present which can be placed before the eyes of students are, first, the position of a university professor, and secondly the position of a scientific advisor in some corporation or a position in the public service. Now the institution of a central research laboratory will at once place before a student an inducement to take up research work such as we have on hand at present, until qualifying for a higher position, and I look upon the establishment of such a research bureau as the most useful assistance to the university. Therefore, simply as a university professor, I look upon such a central institution of research as a most desirable thing from the university standpoint, and I, with all my strength, recommend the establishment of such an institution.

Dr. MacLaurin, University of Saskatchewan, saw no reason why the two ideas would conflict. The establishment of a research

bureau similar to what is in Washington, is unquestionably needed in this country. It is absolutely essential for the standardization of all commercial products, and as far as the university is concerned, if the Council adopt the proper attitude, he saw no failure. It has not been the experience in the United States that the Bureau of Standards or any of the other centralized organizations at Washington has had any depressing effect on research in universities, and he did not see any reason why it should have here, and if the policy is developed with care the central research bureau should be of great assistance, as Dr. Ellis has said, to the research work in the university. To illustrate the subject he said the fuel problem in North America is a fundamental problem, and the line of attack in solving that problem is the method of combustion. Practically all the coal burned in Canada is by direct combustion in air. Eighty per cent. of the total amount of coal that is used in the United States is at least by direct combustion. In the report that Dr. Van Manning made last year, he stated that "Owing to inefficient methods of combustion, $500,000,000 were wasted last year in America." That is, if new methods of combustion were adopted generally,there would be an economy of 25 per cent. Now, it seems that it would be an opportunity for the Research Council and for other individuals of the Chemistry Committee to make known in some organized way the best method of combustion of coal. Take our Western coals for instance, or Alberta coals, there is no difficulty. Alberta coals may be burned directly in air without any smoke whatever. Then, another from the power point of view. The recent work which has been done with pulverized fuel furnishes a method by which we get perfect combustion. As a matter of fact, a great many power houses in America are working pulverized fuel in preference to oil or gas. Now, that is a big advancement in the methods of combustion. These facts are known. It seems to me that if some general method, or if that general method were published with the support of the Advisory Council, a great deal of good would be accomplished. That is, if 25 per cent. of coal should be saved, it would save our transportation to that extent. Now another phase of that problem. Looking at the war situation. At the present time Germany controls the largest part of the oil, coal and iron resources of Central Europe. The United Kingdom owns about one-quarter of the coal of Europe and less than one-tenth of the iron. It seems that in time, it will be a question of the natural resources. The nations, or allied nations who have the greatest wealth in natural resources will be the ones who come out victorious ultimately in this terrible struggle. It would be wise for us to collect all the data of our resources and our allied resources, and endeavor to put forward a policy whereby the resources of this country may be developed. Up to the present time the Allies have co-operated in men and munitions and food supplies. I believe that a much greater co-operation will be essential in finance and in trade of our fuel materials before our ultimate aim will be accomplished.

Dr. Lehmann, Professor of Chemistry, University of Alberta: I think all the plans suggested are very hopeful. One of the things the University has first to do, is to train young men in research work. At present too many of our research men go abroad for their training in their research work. Very few come back to us later on, If the Research Council could continue that policy of aiding the research in the universities in whatever way they can, they will be doing very good work indeed. We must invite the young men to stay in the university for a few years after they have graduated to inspire in them that spirit of research which they can acquire much more easily in their own university than if they go to some other university and go there with the object of securing a large salary as quickly as possible. There is no place where research can be aided as much as in the home university, provided we give the student some incentive. I have been failing to retain number of the very limited number of students in our research work. If we could in some way or another increase that number by giving them scholarships to such universities as Toronto University or McGill; if the Western Universities could be developed to the required standard by research professors; if the whole of our universities should encourage research work among the young men and then give them an opportunity of doing further research work at such a central institute as has been mentioned, and that central institute exercise a general supervision and an actual influence, I think we wou d be develloped very largely. Although Germany may be that cruel, selfish nation which it is, still it has done a great deal for science for its benefit. One of the pillars upon which the research work of our Dominion ought to rest is opportunity after graduation and fuller training.

Mr. Theo. H Wardleworth, Imperial Munitions Board, said: It appears to me that the suggestion of the guild by Dr. Macallum is a very apt one, for the simple reason that it begins to do something. Now, I am most anxious that something should be done. The big institute may be something for the future, but it would be possible to start gui ds without delay. It would be something of world benefit, and it would answer also the idea of the McGill University, for the simple reason that if you take industries, in groups, you can educate them to see the importance of pooling their interests and combining together to perfect as far as possible the industries in which they are interested. The idea of the central laboratory is an excellent one, but may I point ut that these laboratories to which reference has been made have grown gradually, and have developed from small beginning . Tho e who have been privileged to go through the Bureau of Standards may possibly have had the privilege of lunc ing there, and if you had, you would have noted that the table was of unusual pattern. I asked Dr. Staunton whether the table was a standardized one, but he assured me that they began with a very small staff and sat at a round table. As they grew they put wings in and, therefore, the unusual pattern. If you sit in one corner of the round, you seem to be able to see everybody. If we start with the guilds, we have done something, and the other will follow naturally. And, in the same case, the Mellon Institute. When the Mellon brothers started they started with their own money, and it was a group of shacks, nothing else than a wooden building on the side of a hill, and now the Mellon Iustitute is a magniffcent building, but the outcome of small beginnings.

I would suggest to the Council of Industrial Research, that if we could not have a central Mellon Institute or a connecting institute, we at any rate should attach to the various universities a group of research students and fellows who would carry on during their course at the university, and afterwards carry on research work under the guidance and encouragement of their immediate friends at the university.

Some of the universities have peculiar and local advantages for research work. Take the Western Universities, they have their own problems there in agriculture and mining and their own advantages, where observations can be carried on to the best possible advantage of all concerned. You have Toronto, with its peculiar geological advantages for carrying on certain research work. I refer to the clay investigations, and the butter investigations which have been carried on there, and which are peculiar entirely to Toronto. Researches might centralize there. Montreal has its problems in connection with its forestry products, and it is doing excellent work. I would suggest that if we could do nothing more, we might begin with guilds, and when these are developed, be able to proceed to the other bureau if found desirable. We should have such a bureau as I have recommended, similar to the Bureau of Standards. Just to show how naturally a thing of this kind grows, the Bureau of Standards was at first physical and standardized thermometers, glass ware, etc. While I was there, they were standardizing the color of butter, and standardizing paper, and to that end they had established

almost as complete a paper making plant as that of our friend, Dr. Bates, in Montreal.

Dr. Bates—I happen to be in charge of a Government Scientific Branch, organized in a more or less favored way, namely, by being located at a university. The Forest Products Laboratories, as you know, under the Forestry Branch of the Department of the Interior, are located at McGill University. There is a contract between the Government and the University in scientific work. This question of centralizing and co-ordination of research is an important one, but it seems to me that the centralizing or locality is not particularly important. In other words, we have annihilated distance to a large extent in modern times. There can be centralized research throughout Canada, even though research laboratories are located in widely separated parts of the country. Speaking from the point of view of our own organization, it is still a question whether we would be better off located at Ottawa under this large roof, or whether we should remain at Montreal, located at McGill University. I believe we may retain much of the advantages of a central institute by remaining in our present location, or perhaps in a new building at McGill University. This question of guilds is of interest, because we have a practical example in connection with our own work. The pulp and paper industry is one of the most important industries in the country controlled by science. We have had a wonderful response from that industry in connection with our research and experimental work on a co-operative basis, for the benefit of our particular industry. I happen to have spent all the morning at a committee meeting of the directors of forestry and a representative of the pulp and paper industry, where we were trying to work out a scheme for the co-operation of the industry and our department on pulp and paper scientific work. The technical branch of the pulp and paper industry at the present time has of its own initiative, offered to raise money from the industry to supplement our government appropriation for pulp and paper work. I think this is a most inspiring example. The industry is very anxious to arrive at the best method of co-operation, not only financially, but in a practical way, to help or direct our scientific investigations, which is the most important problem that the industry has to face, and to help us during the progress of these investigations. I would like to explain at some length on this particular example, but time will not permit. We recognize that to hold the world's markets we must improve the quality as well as increase the quantity of our output. There are a few industries who have already associations or guilds, and this is one example where they have offered help.

THIRTY-FOURTH GENERAL MEETING OF THE AMERICAN ELECTROCHEMICAL SOCIETY.

Contrary to original plans, which called for the holding of this meeting at Princeton University, the Society met at the Hotel Traymore, Atlantic City, Monday, September 20th for a three days' session. The commandeering of the universities and colleges by the United States Government, rendered the laboratories at Princeton unavailable. A visit to Atlantic City, however, at this season of the year, is by no means a hardship.

A most interesting program of papers, moving pictures and demonstrations was carried out. On Monday the following papers were read:

(1) Processes within the Electrode which Accompany the Discharge of Hydrogen and Oxygen, Donald Smith, Professor of Chemistry, Princeton.

Measurements of the changes in electrical resistivity and in length, caused by using wires of palladium, platinum, tantalum and iron electrodes, generating hydrogen and oxygen. Using high current densities, platinum cathode wires, saturated with hydrogen, decrease in resistivity. Traces of this effect are found with palladium, tantalum and iron. Corresponding changes in volume accompany the electrical changes. Some theoretical explanations were advanced along the lines that these changes in volume were due, for the most part, to the expansive force exerted by hydrogen in a form distinct from that which produces the commonly observed increase of resistance during occlusion.

(2) The Sign of Potential, O. P. Watts, University of Wisconsin.

A historical retrospect was given concerning the usage of electro-chemists in designating the signs of potentials. If present, conceptions are correct and the electric current is a flow of (so-called) negative electrons, then these would flow only to material of relatively higher (more positive) potential. The proposed inversion of signs would contradict these facts.

(3) An Apparatus for the Separation of Radium Emanation and its Determination Electroscopically. -J. E. Underwood and H. Schlondt, U. S. Bureau of Mines, Colorada and University of Missouri.

The necessary apparatus was described along with the method used in determining radium in various ores and concentrates. The material was treated with concentrated sulphuric acid or fused with alkali carbonate mixture or alkaline bisulphate in one part of the apparatus and the emanation stored in another part. The thorium emanation was first allowed to decay before the radium emanation was transferred to an electroscope for measurement.

(4) Notes on the Heterogeneous Equilibrium of Hydrogen and Oxygen Mixed with Radium Emanation. S. C. Lind, Radio Chemist, Bureau of Mines, Golden, Colo.

A discussion of the catalytic effect of radium emanation on causing hydrogen and oxygen to combine. It is shown experimentally that 99 per cent. will combine at ordinary temperatures before equilibrium is reached. Equilibrium theory would indicate 50 per cent. This discrepancy is explained by the fact that as the condensed water formed collects into drops, the decomposing effect of the alpha rays on the liquid water decreases as the drops increase in size. When all the water is in one hemispherical globule, the equilibrium calculates out 95.5 per cent. Moist radium salt, enclosed in a glass tube, has its residual moisture decomposed, producing a high pressure before equilibrium is attained.

(5) Hardness of Soft Iron and Copper Compared. F. C. Kelly, Physicist, General Electric Company, Schenectady, N. Y.

Samples of American "Ingot Iron" and ordinary commercial cold-rolled copper were given similar treatments in an electrically heated vacuum furnace, and then carefully tested for hardness by the Brinell Methods. The treatment consisted in annealing several hours at 770 degrees to 950 degrees, annealing in hydrogen and in a vacuum. Commercial copper ranged from hardness 80, as received, down to 40; ingot iron from 95 to 60. The dead soft iron can be whittled with a knife, and may find uses in place of pure soft copper.

(6) Nitrogen Fixation Furnaces. E. Kilburn Scott, Electrochemical Engineer.

Various types of electric furnaces for fixing nitrogen were first reviewed and compared. The Kilburn Scott three-phase furnace was described in detail and comparison along the following lines: balance of current phases, starting the furnace, size, radiation and cooling-water losses, electrodes, stabilizing the arc, power factor, reactance, air supply, air compressor, pre-heated air, effect of increasing pressure, absorption of products, cooling of gases, raising steam in boilers, theory of the reaction and its reversibility.

(7) Relative Volatility of Refractory Materials. W. R. Mott, National Carbon Company, Cleveland, O.

A study of the order in which substances volatilize in the electric arc, and vapors condense from the arc. The time factor in volatilizing equal atomic quantities of elements or molecular quantities of compounds was considered. Theoretical considerations were advanced concerning the ratios of absolute boiling points to melting points, and a universal vapor pressure curve applicable to all substances.

(8) The Discharge Characteristics of a Common Type of 2½ by 6 Dry Cell. C. A. Gillingham, National Carbon Company, Cleveland, O.

These tests were made by discharging to a given end-point voltages, (1) Through constant resistances, (2) At constant current through varying resistances, (3) Through Mazda lamps. In each case the cells were discharged either continuously, or half, quarter, eighth, etc. of time. The results were given and discussed in extenso.

On Monday evening a motion picture exhibition was given. The American Cyanamid Company showed their process for the fixation of atmospheric nitrogen as worked at their Niagara Falls plant. The United States Steel Corporation ran their Triplex Steel Process as worked at South Chicago, and the Shawinigan Water and Power Company again displayed the possibilities and development of Shawinigan Falls power at Shawinigan, Quebec. This method offers better facilities for advertising Canadian industries abroad than does any other single means.

"Electrochemistry After the War" received special attention on Tuesday. Many well known workers presented the whole situation in an able manner. Addresses were delivered as follows: The Electric Furnace After the War, F. A. J. FitzGerald. The Future of Electric Steel, J. P. Mathews. Electric Pig Iron After the War, R. Turnbull. The Future of Electrolytic Chlorine, A. H. Hooker. Commercial Uses of Chlorine, Dr. Van R. Kokatmur. The Government and the Technical Man After the War, F. A. Lidbury. Tariff Problems in the Electrochemical Industries, Grinnell Jones. The War and the Nitrogen Industry, W. L. Londis. The Power Situation After the War, C. A. Winder. Research After the War, W. D. Bancroft.

On Wednesday a demonstration of the High Frequency Oscillatory Current Electric Furnace of the Pyrolectric Instrument Company, Trenton, N.J., was given by Dr. E. F. Northrup.

Inasmuch as the application of electric power to industry, chemical or otherwise, is one of the great lines of future development along which Canada is sure to progress, meetings of this kind have a special significance for us. The American Electrochemical Society would do well to consider a Canadian route when planning its next extended tour.

CANADIAN PATENTS

Reported for the Canadian Chemical Journal, by A. E. MacRae, Ottawa.

185,457, July 9, 1918. Electrical Precipitation of Particles from Fluid Streams, C. W. Girvin, Con. The material deposited on the active electrode is removed in an inactive zone. The apparatus used is provided with means for moving the collecting electrode system between the active and inactive zones and means in the latter zone for removing the deposited material.

185,330, July 2, 1918. Method of Treating Polysulfid Solutions, E. C. Holton, Can. Polysulfids are stabilized by adding to the prepared ploysulfid solution of sp. g. 35 -40 Baume cane sugar equivalent to one to five per cent. of the weight of the polysulfid solution.

185,384, July 9, 1918. Substitute for Whiting, H. B. Kipper, Can. In making artificial whiting a salt of oleic acid is added to the $CaCO_3$ or other material. The product possesses the characteristics of natural whiting.

185,198, July 2, 1918. Physiological Fertilizers, N. A. Barbieri, Can. The fertilizer claimed consists $K2SO_4$, $KHSO_4$, $Ca_3\ (PO_4)_2$, $Mg_3\ (PO_4)2$, $CaSO_4$, SiO_2, $CaCO_3$ and $MnSO_4$. The seed is thoroughly mixed with or coated with this material just before sowing.

185,164, June 25, 1918. Electrodes, A. T. Stuart, Can. The electrode has a multiplicity of current conducting paths free at each end and forming the reacting surfaces of the electrode. These surfaces are electrically connected with unobstructed spaces between them for the freedom of movement of the electrolyte and the electrolytic products of the reaction.

185,165, June 25, 1918. Electrolytic Apparatus, A. J. McDougall, G. N. Middleton, Can. The diameter of the offtake from the cell bears such proportions to its length that the evolved gases during their ascent through the offtake convey with them portions of the electrolyte which is separated from the gases by passing through a temperature regulated separating means and returned to the cell.

185,166, June 25, 1918. Chemically Extracting Pure Metals, F. G. Clark, A. T. Stuart, Can. Ore and a gaseous reagent in regulable quantities are passed through a reaction zone at a temperature lower than the fusing point of the metal to be extracted. The quantities used are limited only by the capacity to deliver the required heat imput to the ore and gaseous reagent.

185,315, July 2, 1918. Silicon Carbide, O. Hutchins, Can. Articles are shaped from a mixture containing SiC and a binder of such nature that when heated there will be left a large residue of C to form a matrix to surround each particle of SiC. The mixture is baked to expel the volatile matter of the binder and form the C matrix. The articles are then baked in an atm of Si and SiC to convert the C into SiC and produce a homogeneous mass having a continuous structure.

185,428, July 9, 1918. Steel Making Processes, V. Preston, Can. The charge is treated first with a basic then with an acid slag in the same furnace which is lined with $Zr_2\ O_2$.

185,144, June 25, 1918. Purified Crystalline Alumina, F. J. Tone, Can. A cryst alumina containing less than 1 per cent. and over 0.1 per cent. of TiO_2 is made by mixing C with the aluminous material, melting the mass and adding to it an oxidizing agent to oxidize the C or carbides formed and allowing the mass to cool. The product has a highly developed cryst structure and when crushed the grains are comparatively weak.

185,156, June 25, 1918. Iron Sponge, G. Grondal, Can. Fe sponge is made by reducing the Fe ore and introducing the hot product into water freed from $H_2\ CO_3$.

185,155, June 25, 1918. Purification of Water, H. Kriegsheim, Can. The water is chlorinated and then filtered through an exchange silicate thus removing the Cl taste and hardness. The filtering medium may be a material comprising an oxide of a metal having two stages of oxidation or two successive parts of manganese oxid and nickel oxid.

185,119, June 25, 1918. Fixation of Nitrogen, I. W. Cederberg, Can. Nitrogen is passed over mercury at 300° to 350° C. and the mercury nitrogen compound formed is reduced with hydrogen to form ammonia.

185,039, June 25, 1918. Battery Depolarizer, C. B. Schoenmehl, Can. A mixture of an oxide of a metal with a sulfide of the same or a different metal is used as a depolarizer for voltaic cells.

185,414, July 9, 1918. Ammonia Condensers, C. W. Vollmann, Can. The condenser comprises a condenser element having a closed circuit to which the NH_3 gas is admitted and from which the surplus liquid NH_3 is drawn.

185,325, July 2, 1918. Phosphate Fertilizer Containing Nitrogen, A. Foss, Can. Raw phosphates associated with $CaCO_3$ are mixed with sufficient HNO_3 to render a dry reaction product.

185,295, July 2, 1918. Hydrocarbon Product, W. A. Hall, Can. The fuel specified has larger fractions boiling at temperatures below 80° than any hydrocarbon distillate of the paraffin series with similar sp. g., and has an initial boiling point at least as low as that of ordinary gasoline and a calorific value and sp. g. both higher than that of ordinary gasoline and is relatively free from liability to pre-ignite. The C to H ratio of the fuel is about 6.73 to 1 and at 26.7° it has a vapor pressure equal to about 12 inches of Hg.

185,437, July 9, 1918. Extraction of Tungsten, E. M. Hamilton, Can. The ore is ground and mixed with water containing an alkali metal carbonate or bicarbonate to form a pulp, the ratio of solution to ore being between 1:1 and 2:1. The pulp is

then heated under pressure to complete the reaction. The solution is filtered and the W is recovered from the alkali solution by the addition of an acid.

185,296, July 2, 1918. Liquid Fuel, W. A. Hall, Can. The motor fuel having a sp. g. over .76 has not less than about 61 per cent. volatile at 100 and is substantially free from yellowish colloidal resinous matter.

185,145, June 25, 1918. Aluminous Compositions, O. Hutchins, Can. A crystal product containing BaO is made by fusing in an electric furnace a mixture of bauxite containing BaO and C, the latter in sufficient quantity to reduce the major portion of the Si, Fe and Ti oxides, but not sufficient to reduce the BaO.

186,287, August 27, 1918. Fertilizers, H. Blumenberg. Three parts $CaCO_3$ are mixed with one part $CaSO_4$.

184,256, May 7, 1918. Hydrocarbon Conversion, C. J. Greenstreet. This is a re-issue of No. 152,705, Dec. 23, 1913. A non-drying hydrocarbon mixed with steam is rapidly passed through a coil of pipe at about 1000° F.

184,217, May 7, 1918. Rubber, The Canadian Consolidated Rubber Co. Rubber is submitted to the action of vacuum to remove entrapped fluids, the vacuum is broken and CO_2 and a substance non-deleterious to rubber is added to fill the cells and voids left in the rubber.

184,279, May 14, 1918. Cracking Hydrocarbons, J. W. Court. The hydrocarbon is cracked in a still under more than 50 lbs. pressure, the vapors condensed under a similar pressure, the high boiling fractions are returned to the still where relatively cool steam is introduced and the mixture is maintained under a pressure of one atmosphere in a main condenser. Appearance is also specified.

186,545, September 17, 1918. Vegetable Carbon, J. G. and Geo. Penrose. A filtering, deodorising and decolorising charcoal consisting of carbonised conifer needles is made by partially decomposing the needles with lime then heating to a low red heat and then removing soluble matter by washing with dilute acid and pure H_2O.

186,307, August 27, 1918. Apparatus for Heating Castings, R. W. Wiederwax. A casing is divided into upper and lower chambers by means of horizontally arranged pipes which deliver air to the lower chamber and support a heat absorbing and radiating material placed in the upper chamber and burners are provided in the lower chamber for heating the filling material which imparts its heat to the castings gradually and evenly, thus preventing cracking or distorting of the castings.

186,408, September 3, 1918. Electric Batteries, R. C. Benner. $K_2C_2O_7$ or other chromate salt is added to a dry cell to prevent corrosion of the zinc electrode except when the battery circuit is closed. About 10 grams of the salt mixed with the paste in each cell gives an increase of 57% in service life and a decrease of zinc corrosion of 81% on storage.

186,446, September 10, 1918. Chlorinating the Fatty Side Chains of Aromatic Hydrocarbons, H. D. Gibbs, et al. The side chains of the aromatic hydrocarbons which have one or more side chains are chlorinated by subjecting a mixture of the hydrocarbon vapor and chlorine gas to the action of ultra-violet light rays.

186,741, September 24, 1918. Electric Resistance Alloy, W. A. Scheuch. Ni and Co are alloyed with Ti and may have a substantial amount of Cu and or Mn. Ten per cent. of Ti with 75 Ni and 15 Co gives an alloy having a sp. resistance of more than 50 times that of Cu and which is malleable and very durable. The working qualities are improved by the addition of about 10% of Cu or Mn.

186,730, September 24, 1918. Heat Treating Furnaces, T. F. Baily, et al. The furnace is provided with means for automatically feeding billets. An electric controlling means forms an operative connection between a thermally controlled device controlled by the temperature of the furnace, and the means for feeding the material through the furnace and controls the starting and stopping of the means for moving the material through the furnace,

186,259, August 27, 1918. Magnesium, G. O. Seaward. An electric current is passed through a molten bath including flourids of Mg., Na and Ba. The bath carries MgO in excess of the portion soluble therein and has a density sufficient to prevent rapid subsidence of the undissolved portions of the MgO. The Mg is withdrawn in the molten state from the upper portion of the bath.

186,729, September 24, 1918. Apparatus for Electrical Treatment of Gases. L. Bradley. The apparatus consists of flues constituting electrodes arranged so as to form spaces between the flues, discharge electrodes connected with supply conductors extending longitudinally in the flues, means for forcing gas through so as to maintain a condition of pressure and means for thermally insulating the chamber in which the flues are to retain the heat of the gas.

186,290, August 27, 1918. Fur Dyeing Machines, M. Dickerson. The apparatus comprises a cylindrical surface over which a skin is passed with the fur outwards, a dyeing brush and several rubbing-in brushes which come in contact with the fur and a flue for catching the surplus dye from the brush and returning it to the dye trough.

186,444, September 10, 1918. Oxidizing Aromatic Hydrocarbons, H. D. Gibbs. Aromatic hydrocarbons containing an aromatic nucleus and a fatty side chain are oxidized by passing the hydrocarbon with an O containing gas over a catalyst such as vanadium oxide, at a temperature between 200 and 500° C.

186,445, September 10, 1918. Process of Oxidizing Aromatic Hydrocarbons having a Plurality of Side Chains, H. D. Gibbs, et al. Hydrocarbons having an aromatic nucleus combined with either side chains or a ring at two points of the said nucleus, i.e., xylenes or anthracene, are oxidized by passsing the hydrocarbon and an O-containing gas in contact with a vanadium oxide catalyst at a temperature between 250° and 650° C.

186,640, September 17, 1918. Process of Separating Molybdenum and Molybdenum Compounds from Substances. E. H. Westling, et al. Molybdic acid is precipitated as a molybdate of a trivalent base and the molybdate is digested with soluble base to produce a molybdate of a soluble base. If the acid occurs as an alkaline molybdate, $Fe_2(SO_4)_3$ may be used to precipitate it. If it occurs in acid solution, Na_2CO_3 is used to neutralize the solution.

186,421, September 3, 1918. Potash and Alumina from Silicates, B. F. Halvorsen. An alkali alumina silicate is heated with CaO, C and N non combined, as CaC_2 and N or as $Ca\ (CN)_2$ to a temperature above 700° C. The product may be used as a mixed K-N fertilizer or further treated to expel the N.

186,632, September 17, 1918. Chlorhydrins, K. P. McElroy. The olefins in the gaseous form are treated with Cl in the presence of water at about 100° C. By increasing the amount of water the dichloride content of the product is reduced.

186,633, September 17, 1918. Manufacture of Glycols and Glycol Derivatives, K. P. McElroy. A concentrated solution of glycols containing the glycols corresponding to the olefins of oil gas from petroleum cracked at a temperature about 700° C. is prepared by heating the olefins dibalids in the presence of water and a Ca salt of a weak acid.

186,593, September 17, 1918. Electric Furnace, J. W. Moffat. The furnace operates with three phase current and is provided with three electrodes arranged in plan at the angles of an equilateral triangle in which the inner surface of the wall of the crucible in plan is shaped as follows: Adjacent each electrode curved substantially on an arc of small radius relative to the spacing of the electrodes and struck from a centre in the axis of the electrode and between any two electrodes curved on an arc struck from a centre adjacent the opposite arc of smaller radius.

186,369, September 3, 1918. Electric Furnace, B. C. Kvarno. The opening in the furnace for receiving charge working tools

has a spheroidal socket in which is a ball which has a tool-receiving aperture adapted to be brought into registration with the furnace opening.

186,463, September 10, 1918. Fuel Compositions, J. T. Dennis. Coal dust, clay, pea coal or coke and cinders are mixed with shavings coated with tarry material and the mixture is pressed into blocks.

186,716, September 24, 1918. The Destructive Distillation of Carbonaceous Substances, S. N. Wellington. A high yield of permanent gas is obtained by submitting coal in a retort to a comparatively low temperature and in a free space at the top of the retort above the charge, heating the gas and vapor to a higher temperature than the charge. A mass of metal or other material may be suspended in the space above the charge to facilitate the decomposition of the gases and vapors.

186,422, September 3, 1918. Potassium and Aluminium from Silicates, B. F. Halvorsen. An alkali Al silicate with $Ca(CN)_2$ is heated in the presence of H_2O in the form of superheated steam; and the resulting soluble compounds of K and Al are recovered. The addition of chlorides or nitrates facilitate the reaction. The N is recovered in the form of NH_3.

186,634, September 17, 1918. Chlorhydrins, B. E. Eldred. Chlorohydrins are made from gaseous olefine by establishing a flowing current of steam in a chamber provided with means for absorbing HCl and adding Cl and oil gas thereto in alternating portions. The same body of steam is used for a number of reactions so a stronger solution of chlorhydrins can be attained and at the same time the production of dichlorides limited. Apparatus is also specified.

184,218, May 7, 1918. Pigmented Rubber, The Canadian Consolidated Rubber Co. A dry comminuted pigment is applied to the surface of a rubber mass which contains a vulcanizing agent, a metal foil layer is placed under the pigment and the material is vulcanized.

184,252, May 7, 1918. Tanning, Andrew Turnbull. A tanning material consists of an aqueous starch filler of colloidal liquor containing tanning agents made by the addition of starch to the solution in water and heated to 180°.

184,753, June 4, 1918. Sheet Rubber, The Gutta Percha and Rubber, Ltd. A sheet of washed and dried pure rubber is united to a smooth sheet of washed dried and broken down rubber and vulcanized.

184,741, June 4, 1918. Sheradizing, Canadian General Electric Co. The article to be treated is submitted to the action of zinc dust containing not less than 80% nor more than 92% metallic zinc the remainder being ZnO at a temperature between 350 and 375° C.

184,763, June 4, 1918. Serum for Diabetes, Parke, Davis & Co. A serum which decreases blood pressure and increases sugar metabolism is prepared by administering to horses or other suitable animals an extract of the pitnitary body and then deriving the serum.

CHEMICAL ENGINEERING

A well-attended meeting of members of the society, chemical manufacturers, engineers and others interested in chemical engineering, convened by Prof. J. W. Hinchley, was held in London on July 29, Prof. G. T. Morgan presiding. Prof. Hinchley outlined the steps that had been taken prior to the meeting to develop the scheme that was to be submitted to those present through the following resolutions:—

1. "That a Group be formed for the promotion and study of chemical engineering." 2. "That a Committee be elected, with full power to act, to draft rules and to meet the Sub-committee appointed by the Council of the Society of Chemical Industry, with a view to this Group becoming a Section or Group of the Society of Chemical Industry." 3. "That the activities of the Group be under the control of a Committee and Officers elected under rules similar to those of local Sections of the Society of Chemical Industry." 4. "That a special subscription be levied to cover the cost of organization and work of the Group, and particularly that of printing and posting of papers prior to their being read." 5. "That one of the objects of the Group be to promote vigorously chemical engineering research." In supporting the last resolution, Mr. L. G. Radcliffe, of the Manchester Section of the Society, expressed the strong interest of the Manchester technologists in the future development of chemical engineering education, industry and research.

The resolutions were all carried unanimously.

A proposal to fix the membership fee for the Group at one guinea per annum was carried.

In reply to queries, Prof. Hinchley sketched the proposed work of the Group, which is to consist *inter alia* in arranging frequent conferences at various centres throughout the country, at which papers will be read and discussions take place on the more important problems and operations of chemical egineering, particul lar regard being paid to the branch of industry of most local importance. It is proposed that the Chemical Engineering Group should occupy the position of a "subject section" of the Society of Chemical Industry ,as opposed to a territorial section, and that members of the Society should be *ipso facto* eligible for membership of the Group. It is intended that the views expressed at these special meetings shall be fully representative of the latest knowledge and experience in the subjects under discussion, so that the pronouncements of such meetings, with certain obvious limitations, shall be authoritative. Prof. Hinchley intimated that it was the intention of the Group to begin a vigorous campaign to promote original investigation in technical colleges and schools, and also in works, as he believed adequate financial backing to such a programme could be obtained if a responsible and fully accredited body were charged with its supervision and general organization. Most of the speakers deplored the backward state of research work of this kind in the United Kingdom, and the meeting was very strongly in favor of energetic measures being taken to establish chemical engineering education and research on a progressive basis.

The following were elected to serve on the Committee of the proposed Group, and to elect a Sub-committee in accordance with resolution II.:—

Prof. J. W. Hinchley, Capt. C. J. Goodwin, Drs. W. R. Ormandy, H. C. Greenwood, H. J. Bush, and Messrs. C. S. Garland, A. J. Liversedge, F. H. Rogers, E. A. Alliott and H. Talbot (Hon. Sec.).

Until the sub-committee shall have completed its work and the decision of the Council on the question of the Chemical Engineering Group, becoming a "subject section" of the Society shall have been made known, the arrangements made are to be regarded as provisional only, but the enthusiasm of the meeting was such as to indicate that a very distinct want would be supplied by the inauguration of some such organization as that contemplated. In the meantime, all who are interested can receive any desired information from Prof. Hinchley, at the Imperial College of Science and Technology, South Kensington, London, S.W., or from the Secretary, at 15 New Bridge Street, London, E.C. 4.—Journal of Soc. of Chemical Industry.

WORLD'S PRODUCTION OF TUNGSTEN

The world's production of tungsten ores has increased from 10,000 metric tons in 1913 to 19,000 metric tons in 1916, the latest period for which returns have been compiled. The countries producing the most tungsten are the United States and Burma. In the former the production has increased from 1,397 tons in 1913 to 6,790 tons in 1916, and in the latter from 1,732 tons in 1913 to 4,123 tons in 1916. Portugal stands third in production with 1,600 tons; Japan fourth with 1,150 tons, and Australia and New Zealand fifth with 1,129 tons. Although there are deposits of tungsten in Canada, no producing mines were reported in 1916.

MONTREAL LETTER

(Correspondence of the Canadian Chemical Journal, By J. C. Ross.)

MONTREAL, Sept., 1918

There is very little new to report in connection with the chemical markets, except to say that the restrictions due to licenses, permits, etc., are becoming more and more exacting. Dealers in chemicals are really at their wits' ends to know where and how to secure the necessary supplies, owing to the stringent regulations being put in force at Washington. For example, log wood. used by the textile manufacturers and tanners, is under the ban by Washington. Recently a letter from manufacturers was sent out to dealers, asking them what their customers had used on government work and for other more or less non-essential activities, the object of these inquiries being to find how further restrictions could be imposed. In the case of bichromate of soda other hardships are being experienced, there being practically no supplies coming through. One of the largest houses in Montreal stated that they had some on order to help out the manufacture of dry colors. In this case, they have a license from Washington, but it has to be further approved by the Bureau of Mines, the additional check being put on to make sure that sufficient supplies are available for the steel people and munition makers. Dealers are asked to use substitutes, but the trouble is that it is next to impossible to get substitutes. This same Montreal house said that they have some supplies from England, which they are using, but do not know what to do when those are exhausted.

In the case of chloride of lime, used by textile manufacturers, laundries, etc., the United States Government have cornered the supply of lime and are using it to fill their own orders first. It is a sort of "devil take the hindermost," because they are more or less indifferent to what supplies are available for ordinary domestic purposes. The result of all these complications is seen in the steady and persistent efforts at Washington and Ottawa to get supplies through, while dealers are conscious all the time of a rising market and an increasing clamor from their customers. Supply houses are doing the best they can under very trying circumstances.

The Canadian Society of Chemists are getting things in first rate shape for their winter's programme. According to present indications they will have a very profitable season. The first meeting takes place about the middle of October, when a discussion will be held on the advisability of organizing the Canadian chemists so that they will receive the same recognition that is now accorded other professional bodies. Following this meeting will come one devoted to the coal question—a most important one in the present time of fuel shortage. A third one will probably be devoted to collodies and fine grinding. The Society are now conducting negotiations with the Canadian Engineering Institute for the purpose of securing the latter's building for the holding of their meetings.

Grand Mere and the district tributary to the Shawinigan Water & Power Company's plant has become one of the most important industrial centres in the Dominion, especially since the outbreak of hostilities. To a large extent this locality was chosen as a suitable centre for the carrying on of experiments in war work, especially relating to the chemistry industry. The results of these efforts have been embodied in a series of five booklets which have been issued by the Shawinigan Water & Power Co. The first booklet, devoted to hydro-electric powers, gives an outline of the company's capacity, the mileage of transmission lines, annual output, etc., etc. It also calls attention to the favorable opportunities for the location of industrial plants. Another booklet deals with Shawinigan Magnesium, outlining the physical and chemical properties of magnesium and the uses to which it is applied. A third booklet deals with carbide of calcium, which is the basis of new chemical developments. A fourth booklet deals with the electrode, its sub-title being "The Artery of the Electric Furnace." The fifth booklet is entitled "Great Achievements in the Synthetic Organic Chemistry." The firm announce that they manufacture acetaldehyde, paraldehyde, acetone, acetic glacial, acetic 80%, sodium acetate and mercuric oxide. Altogether the series of booklets present in a clear and concise form the marked chemical and industrial expansion which has taken place in the territory covered by the Shawinigan Water & Power Company.

Mr. George Chahoon, Jr., President of the Laurentide Co. has gone to Baltimore, where he becomes associated with the Chemical Branch of the War Welfare work of the American Government. Mr. Chahoon has always taken a very keen interest in scientific work. His company was the first paper concern in Canada to recognize the work of the chemist, the forestry-engineeer and other technical men. The Laurentide Co. have gone in extensively for reforestation and altogether have become one of the largest and most progressive paper manufacturing concerns in the Dominion. During Mr. Chahoon's absence, the executive work will be carried on by Vice-President C. R. Hosmer, while the affairs at the mill will be directed by F. A. Sabbaton, a director of the company. Mr. Chahoon's services are loaned the United States Government for the duration of the war.

Charles A. Magrath, Fuel Controller for the Dominion Government, has been appointed director of coal operations for Nova Scotia and New Brunswick. The powers given to him are wide. He has power to make all necessary investigation and inquiries respecting wages, holidays, hours of labor, the utilization of labor to the best advantage, and respecting all other matters necessary to and connected with the cost of, and production of coal and "the increase and continuance of such production in Nova Scotia and New Brunswick during the present war and for three months after the end of the war." The order-in-council under which the appointment is made, states that the production of bituminous coal in the Maritime Provinces is diminishing in comparison with last year; that the supply does not promise to be equal to the needs of the country dependent thereon, and that it is therefore necessary that efficient means be adopted to increase the output.

The work the colleges are doing throughout the country is being emphasized more and more by the press of the country, as well as by corporations and Big Business men. They are realizing more and more that the college chemist and scientist, is an indispensable factor in the country's business. The following extract from an editorial in a recent issue of the Journal of Commerce, Montreal, on "The Contributions of the Colleges," follows:

"The Allies have demanded the best, with a result that many of our doctors, dentists, chemists, scientists, and other leaders in college activities have gone overseas to do their bit. Canada owes an inestimable debt to her college men. While not depreciating in any sense the splendid response of the laboring men, the artisan, the clerk, or the farm lad, it is generally assumed that our colleges contain the flower of our young manhood, and they have given themselves without let or hindrance. We who remain behind should at least see that the colleges receive adequate support, while the bulk of the students are overseas doing their bit. In the days to come it is to the colleges that we must look for leadership if the Hun is to be ousted from his former place in the scientific world. In college laboratories and research work, must come the solution of the economic and scientific problems now associated with German denomination. All honor to the college men for the part they have played in the titanic struggle."

Mr. M. J. O'Brien, of Renfrew, who has been appointed to the Senate, is well known in Montreal, as this has been his headquarters for his railway contracting work for the last few years. Mr. O'Brien is owner of the O'Brien Silver Mines in Cobalt, from which he amassed a fortune. He is probably better known as a railway contractor.

A decision reached by the International Waterways Commission permitting the Aluminum Co. of America, to build a

submerged weir on the St. Lawrence River at Messena, New York, has caused great disappointment in Montreal. From this city numerous protests from the Board of Trade, the Shipping Federation and other interested parties, repeatedly protested against the proposal. Despite the protests, the International Commission granted the permit, although the "dam" is only to be in operation for the duration of the war.

The Canadian Export Paper Co., Ltd., are doing everything possible to prepare for after-the-war-trade. A series of meetings are being held at the various mills comprising the Export Co., and an effort is being made to secure uniformity in the output of paper, the adoption of labor saving devices, the employment of technical men and in other ways efforts are being made to bring about a higher degree of efficiency.

Henning J. A. Helin, Technical Manager and Director of the Wayagamack Pulp and Paper Company of Three Rivers, has severed his connection with that concern, and goes to Rainy River Pulp and Paper Co. Mr. Helin is a native of Sweden, but came to this country in 1912 and made a big name for himself as an authority on the manufacture of kraft paper. He is also an active member of the technical section of the Pulp and Paper Association.

CAPT. JOSEPH RACE, F.I.C.

The appointment of Joseph Race, F.I.C., to a captaincy in the Hydrological Corps of the Canadian Expeditionary Force to Siberia, is one that meets with the hearty approval of Canadian chemists, to most of whom he is well known.

Capt. Race was educated at the Burnley Grammar School and Manchester University. On leaving the University he entered directly upon the study of general municipal work in the Civic Laboratory of Burnley, Lancashire, afterwards working under Major Ross, F.I.C., and F. W. Harris, now Public Analyst and Municipal Chemist for Glasgow. In 1905 he passed the examinations of the Institute of Chemistry, obtaining the A.I.C. Three years later he was elected to the Fellowship. His attention has always been directed particularly towards biological chemistry, and in 1911 he was brought to this country as Chemist and Bacteriologist for the Filtration Plant at Toronto. His good work there brought him, in the following year, to the City of Ottawa, as City Bacteriologist and Chemist, where he has efficiently managed the civic laboratories ever since. In 1914, he was appointed a Food Examiner under the Adulteration of Foods Act,

His studies have been carried on along the lines of his regular work and both have met with approval. When he came to Ottawa, the water supply was not good, and typhoid was prevalent, so he studied methods of chlorination with the result that he was successful in originating the chloramine method of treatment, which is now in use both in Ottawa and Denver, Colo. In the typhoid epidemic of the year in which he came to this city, there were 1,200 cases and 80 deaths; this year there were about 20 cases and only 2 deaths, and the water supply is safe. Various papers under his name have appeared in the journals from time to time on subjects relating to the examination of water and milk.

His activities in the chemical world have won him many friends as well as recognition in the field where he has labored. The American Public Health Association claim him as a member of the Committees on Milk and Drug Control and Water Supplies; he is also on the Water Standards Committee of the American Waterworks Association. Last year he was chairman of the Canadian Public Health Association Committee on Standard Methods of Analysis. The Society of Chemical Industry owes much to the untiring energy of Capt. Race, which was largely responsible for the establishment of a branch of the Society at Ottawa. He was the first secretary, and at the Convention of Chemists this year he was given a place on the Organization Committee.

As the author of "Milk Examination for Public Health Purposes," published this year, Capt. Race has won deserved appreciation. "Chlorination of Water," another book from his pen, is now in the press.

Capt. Race volunteered for active service in 1915, and this year was given a commission with the Hydrological Corps, as noted above. He will be in charge of the Hygienic Laboratory of the Base Hospital, C.E.F., for Siberia, and his friends anticipate a continuance of the brilliant record he has already established. He carries with him the best wishes of a host of friends of whom the CANADIAN CHEMICAL JOURNAL is proud to be one.

CAPT. F. A. DALLYN

Mr. F. A. Dallyn, sanitary engineer for the Ontario Public Health Service, has been appointed Hydrological Officer to the Canadian Expedition to Siberia, with the rank of Captain. He is an honor graduate of the University of Toronto (1909), and

CAPT. F. A. DALLYN

has been sanitary engineer for the Public Health Department for five years, having previously served under Dr. Amyot in the chemical laboratory of the Provincial Board of Health. He is a son of Mr. F. E. Dallyn, of Dallyn & Wright, the well known firm of dyestuff and chemical merchants, Hamilton, in which city Captain Dallyn was born. He is one of three brothers who have volunteered to serve their country in the great war. Capt. Dallyn is already on the way to Siberia.

STEFFANSON REPORTS COAL AND COPPER

On returning from his recent Arctic explorations, Steffanson confirms his earlier reports that both copper and coal were found by him on many of the islands he visited. Coal deposits in particular were found in many places and these may some day be of great practical value. Until a very few years ago it was thought impossible that the Spitzbergen Islands in the North Atlantic should ever be of such value as they are at present. Those islands are actually farther north than many of those which Steffanson has so recently reported upon. The output of the Spitzbergen Islands has been greatly stimulated in the last few years, until now this source of coal is quite a factor when considering the future European supply. Further investigation of these new deposits may prove them to be of great value to Canada.

Canadian Government Publications

By S. J. Cook, B.A., Public Analyst, Department of Trade and Commerce, Ottawa

[Notice.—Recent Government publications of scientific, technical, or educational value, are reviewed here from month to month. Unless otherwise stated, these publications may be obtained free, by those interested, upon application to the Department of the Government issuing the same.]

Department of Trade and Commerce

The Laboratory Bulletin Series, formerly reported under the publications of the Inland Revenue Department, will be reviewed from now on with the other publications of the Department of Trade and Commerce, the latter Department having taken over the administration of the Adulteration of Foods Branch, as reported in the September number of the Journal.

Laboratory Bulletin No. 401. Liquor Arsenicals. 18 pp. Analysis of 91 samples of Liquor Arsenicalis or Fowler's Solution are reported. Of these only 12 meet the requirements of the U. S. P., which permits a wider variation in the arsenic content than the B. P. It is pointed out that, judging from this and previous examinations, the accuracy with which solutions of this drug are being prepared is notably on the decrease, and that "many of the samples are so far from accurate as to compel the conclusion that great and culpable carelessness is shown in their preparation."

Laboratory Bulletin No. 404. Fertilizers, 1918, 29 pp. Eight samples of fertilizers in the 1918 collection of 233 samples are found to be deficient in their content of fertilizing ingredients. The number of samples is somewhat less than in former years, probably due to a lessened sale. The "tag system" of checking fertilizer sales is suggested as of value in simplifying the control required by the Fertilizers Act. Analyses, as found and as guaranteed, are given and furnish a guide to the fertilizers on the Canadian market, from the chemical point of view.

Laboratory Bulletin No. 406. Condensed Milk, 19 pp. Condensed Milk was defined in 1910 and must contain not less than 28 per cent. milk solids and not less than 7.7. per cent. milk fat. Analyses of 95 samples show that only one, and that from British Columbia, fails to meet the standards. These standards are easily met in the East, but it is claimed that Western pasturage conditions are such that it is impossible to produce a condensed milk which shall reach the requirements for milk solids, without bringing the fat content considerably above the stated minimum. Revised standards in complete harmony with actual conditions are promised at an early date.

Laboratory Bulletin No. 407. Molasses, 23 pp. The work reported in this bulletin is complementary to that detailed in Bulletin No. 312 (April, 1915), and is intended to furnish a basis for the standardization of molasses. 165 samples of this product were examined and the following determinations are reported: Water and Solids; Reducing Sugars (Fehling's Copper Reduction Method); Sucrose (Clerget Method); Total Sugar (by difference); Organic Matter other than sugar; Net Weight; Sulphite Content. It is suggested that (1) Water and Ash content be fixed; (2) If glucose be present, declaration should be made on the label, and that if such a molasses-glucose mixture is sold from puncheons to the consumer, effective means be taken to inform the buyer of the nature of his purchase; (3) Sulphite content be limited.

Laboratory Bulletin No. 409. Maple Syrup, 23 pp. Judged by the Canadian standards, 137 samples are found genuine and 13 adulterated, one of which is described as a "linseed decoction sweetened with sugar." A comparison with the suggested U. S. standards shows that 14 found genuine would be considered non-genuine at Washington. Several samples are reported as containing excess water. Leniency towards the vendors of these samples is suggested, with the warning that hereafter the law in this regard will be enforced.

Laboratory Bulletin No. 411. Arsenic in Baking Materials, 15 pp. Reports that cheap, unpurified acid calcium phosphate having a high arsenic content was being used in England in the preparation of cream of tartar substitutes led in this country to the collection of 152 samples of baking powders, cream of tartar substitutes, self-raising flours and egg powders in which acid calcium phosphate is often used. The samples were examined for their arsenic content. One baking powder is reported as containing 25 parts per million; five others yield more than 1 part; the legal limit is 2 parts.

Laboratory Bulletin, No. 412. Bran, 21 pp. Analyses of 153 samples of bran. All meet requirements in feed value, but 15 samples contain noxious weed seeds in excess of 25 per pound.

Canada Food Board

Canadian Food Bulletin No. 18, 24 pp. Published to give the public some idea of the activities of the Canada Food Board, this issue deals with the "Eat More Fish" campaign, the sugar restrictions and other Food Board Orders and gives as well biographical sketches of some of the Food Board Officials.

Food Laws, 72 pp. A manual of Orders-in-Council and Orders of the Canada Food Board relating to the production, conservation and distribution of food.

Weekly Bulletin

Published weekly by the Commercial Intelligence Branch of the Department of Trade and Commerce, and circulated only in Canada, this paper contains reports from the Trade Commissioners and Commercial Agents of the Department located in various parts of the world, which are of real interest and value to the exporter and sources of general information to every other person interested in Canadian Trade. In addition, all Canadian War Measures, and such war measures as are passed in other countries that relate to Canadian trade are given in detail. Of particular interest is the resume by the South African Trade Commissioner in Nos. 759-762 of South Africa's imports of chemicals, drugs and kindred lines, last year, which account he follows up with several hints to Canadian exporters in this field. Industrial alcohol and the prevalence of adulteration of leather in Africa are also discussed. Trade inquiries for Canadian products, notes on foreign trade, memos from the Advisory Council for Industrial Research, all find a place in this interesting and instructive little weekly.

Advisory Council for Industrial Research. Bulletin No. 5. Science and Industry, 11 pp. An address given by Prof. J. C. Fields, Ph.D., F.R.S., given before the Toronto Board of Trade, republished now because "in the opinion of the Research Council, the address is of such value that it warrants a wider circulation than it received on that occasion." It is a readable, thoughtful review of the subject, with a strong appeal for Canadian action.

Department of Mines

Report on the Building and Ornamental Stones of Canada, Vol. 5, Province of British Columbia. Wm. A. Parks, B.A., Ph.D., 236 pp., 47 plates, 3 maps.

The excellence of the first four volumes of this report is well maintained by the author in this, the fifth volume, and, while British Columbia contains vast tracts of rocky country of which practically nothing is known, the quarries and other places reported as occurrences of stone suitable for structural purposes in the Province, have been very carefully examined and are described by Prof. Parks in his report, "primarily intended for non-scientific readers," in language intended "to preserve a reasonable mean between the scientific and the popular."

A geological basis of classification has been followed in accordance with the plan of the earlier volumes, despite the fact that this method is less satisfactory than before, because of the great number of formations, and the lack of definite correlation of the formations of different districts. Strict adherence to the basis mentioned has not been observed where such procedure would obscure the economic essentials. A general account of the stone industry of the Province, description of the methods of testing, and a summary of results are collected in one chapter.

The systematic portion of the Report is divided into chapters, each of which is devoted to a particular class of stone, considered, first, on a geological basis, second, on a geographical basis. The subject matter descriptive of each property is arranged as follows:

Location.

Description of quarry—
- General description of stone.
- Physical tests.
- Chemical analysis.
- Quarrying methods.
- Prices, statistics and economic remarks.
- Buildings constructed of the stone.

Much scientific data is collected in the several appendices at the end of the volume which will be found of considerable value to those technically interested. The numerous plates, and particularly the colored ones, deserve special mention. The entire volume is a distinct contribution to the useful technical literature of the Dominion.

Report on the Clay Resources of Southern Saskatchewan, N. B. Davis, M.A., B.Sc., 89 pp., 21 plates, 3 maps. This report of field work carried on during the seasons of 1915-16, supplemented as it is by accounts of laboratory tests determining the quality and behavior of the various clays examined, comes at a time when the demand for fire clays and such other argillaceous deposits as may be adaptable to the manufacture of various structural clay products, is enormously in excess of the supply, and the commercial value of these products is correspondingly much enhanced. The Province of Saskatchewan excels in the quality of its fireclays; hence the present report describing the geological location, the exact locality and the availability of each deposit, is of particular interest. Field-work and laboratory tests form the first step in clay investigations and show whether subsequent tests on a commercial scale are worth while. This report indicates that even before the war the immediate future of the clay industry promised well, and it is suggested that with better transportation facilities, and easier money markets, the clay industry will become well established in this Western Province.

Annual Report on the Mineral Production of Canada for the Year 1916. John McLeish, B.A., 343 pp.

Statistical information regarding the mining and metallurgical production in Canada during 1916, compiled from a variety of sources is collected in this report transmitted last October, and distributed this month. The statistics are valuable, but would be more interesting if it were possible to produce them while they have a news, as well as an historical, value.

The volume contains a general summary in which the mineral production, exports, imports and mine production are given for Canada and for the Provinces separately. Following this the Metallic Ores, Non-Metallic Products, and Structural Materials including Clay Products are each given a section. From the summary it is apparent that mineral production in Canada has progressed from ten million dollars' worth in 1886 to nearly 180 millions value in 1916; further, the increase in production for the ten years ending 1916 was over 120 per cent. Ontario is the largest contributor, producing 45.4 per cent. of the Canadian total in 1916; British Columbia comes second with 22.6 per cent.; Nova Scotia 11.3 per cent.; Quebec, 8.6 per cent.; Alberta, 7.5 per cent., and Yukon District, Manitoba, New Brunswick and Saskatchewan follow in order. The three sections referred to above, which follow the summary, are replete with specific information, thus making the book what it purports to be, a volume of statistics.

LEROY E. WESTMAN, M.A.

Our readers are already acquainted with Mr. L. E. Westman through his correspondence with this Journal last year, and through his carefully prepared reviews of Canadian Government publications, which have appeared regularly for several months, and which will now be conducted by Mr. S. J. Cook, Public Analyst, attached to the Inland Revenue Department. Mr. Westman will now be in closer contact with our readers as Editor of the CANADIAN CHEMICAL JOURNAL, rendering his first service on the staff as a visitor to the Exposition of Chemical Industries at New York.

Mr. Westman was born at Granton, Ont., in 1890, and was educated at St. Mary's and Stratford Collegiates Institutes, and the Stratford Normal School. Entering the University of Toronto, he took the courses in chemistry and mineralogy, and graduated in 1914. In the following year he took post graduate work, leading to the degree of M.A., by a thesis in electrochemistry. He was made a Public Analyst in 1915, and in the same year was attached to the Department of Inland Revenue at the Headquarters Laboratory, Ottawa. He took a post-graduate course at Columbia University, New York, under Prof. H. C. Sherman, specializing in the chemistry of food and nutrition, and during this period was assistant in chemistry to Prof. Alexander Smith. After a short period in the service of the Milton Hersey Co., at New York, he returned to Canada, and re-entered the Government service. He has taken part in the preparation of a number of Government reports and bulletins, and among articles to the technical press are papers in the JOURNAL of the American Chemical Society, and the Journal of the American Pharmaceutical Association.

LEROY E. WESTMAN, M.A.

Mr. Westman has been an active member of the Ottawa Section of the Society of Chemical Industry, and now the Toronto Section will feel the stimulus of his energy and will welcome him to its membership. He is also on the staff of the University of Toronto, as assistant in chemistry.

Fourth New York Chemical Exposition

The Exposition, in short, was the concentrated manifestation of progress along every line of applied industrial chemistry. Every exhibit of the hundreds occupying the three floors of the Grand Central Palace, was the result of progress more or less recent, in some particular line. The nine wonders of the world were outstripped by the significance of many things presented to the eye. It is impossible to give to anyone who was not present, that detailed impression of the magnitude of the industries represented which was received by all those who were able to go and see for themselves. That much of this should be connected directly or indirectly with the war was the predominant idea. The seeds of education that had been sown in years of peace were here shown in early bloom under the new necessity for self-supporting action. The chief value of such an exposition arises from the opportunity it gives the individual to see the things he is interested in all in one place, and to enter into conversation with more practical men in less time than he could otherwise do by any other means.

Only a few impressions may receive attention here. From the Canadian viewpoint it was a novelty to see the insignia (the benzene ring and crossed distilling flasks) on the uniforms of so many men now attached to the Chemical Warfare Service Section of the United States Army. Representatives of this branch of the forces were present to answer all questions and enquiries from chemists regarding the nature of their work, and how and where the American Government could use chemists in its war organization. Gas masks as used by men or horses along with various types of gas shells and bombs were on exhibition as an added attraction.

Chemists of many nationalities were visitors, and it must be specially noted that Japanese scientific men were present in what might be called large numbers. They were most intensely and intelligently interested in each exhibit, and the keenness with which they studied new methods and new ideas in general is something which many individuals much closer and less handicapped might well copy.

The extent to which moving pictures may be utilized in giving concrete conceptions of various methods of operation employed in widely separated plants is simply mentioned in passing. Every evening developments in some set of chemical industries were given on the screen. The possibilities of the more extended use of such means of instruction in our universities is suggested, and possibly in the future, our classes may be called off because the reels have not been expressed on time from some university on the circuit. The reels showing Shawinigan Falls Power Development and surrounding industries were of special interest to Canadians, as well as those of the American Cyanamid Company, Niagara Falls. The manufacture of potash, from various sources, porcelain and glass, zinc oxide, wrought iron pipes, were some of the subjects treated in this way. The program of addresses called for symposiums on Acids and Chemical Engineering, Potash, Ceramics, Metal Industries and Industrial Organic Chemistry. Here again encouraging accounts of progress and difficulties overcome were given by men directly connected with the industry they were talking about. Under the particular head of metal industries, Canada has a very excellent opportunity along several lines to build up manufacturing industries in this country. General manufacturing conditions should be as good or better here eventually in many chemical lines as they are anywhere in America, as far as foreign or domestic trade is concerned. In the general field of ceramics also, it would appear that Canada has her fair share of the natural resources, and in the course of time should hope to realize more fully on these. Indeed, it would seem as if we had not in the past, given due attention to the proper expansion of this industry in our country.

Canadian exhibits and notes on a few of the larger American exhibits are all that space will allow mention of here. In all there were some half dozen distinctly Canadian exhibits this year.

Shawinigan Water & Power Co.

In one group were exhibited the chemical products of various plants at Shawinigan. Giant carbon electrodes, calcium carbide in the now familiar "green" drums, magnesium metal and powder, glacial acetic acid, acetaldehyde, paraldehyde, acetone, sodium acetate and mercuric oxide. An automatic projecting machine ran a series of views showing various plants and power stations and Falls in the Shawinigan district. Keen interest in the matter of electro-chemical development was shown.

Ontario Department of Mines

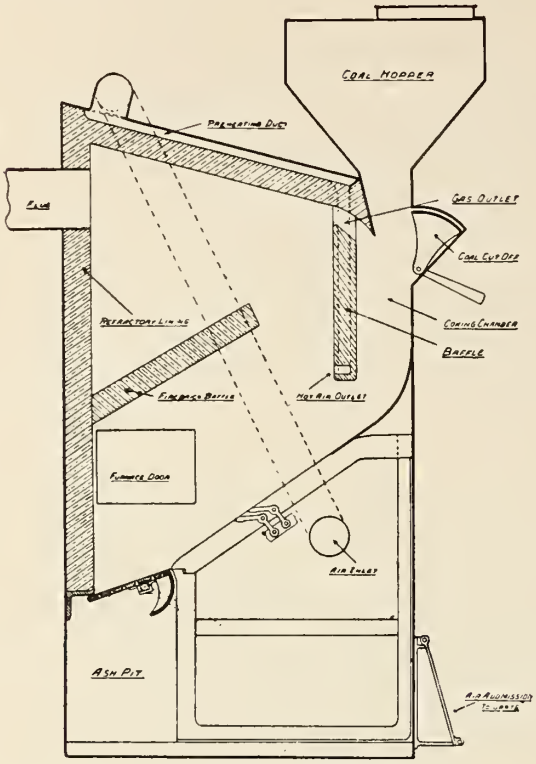
Very few exhibits in the whole show brought forth as much outspoken wonder as did this collection of raw metals and other natural products. Gold and silver in place will always turn this trick. From the Canadian beaver in the centre, to the last piece of rock in the corner, the whole setting was indeed a novel one for most visitors. Nothing could have been better designed to display the possibilities of the mineral resources. Everything was there; gold from Porcupine and Kirkland Lake; silver from Cobalt and Gowganda; copper from Massey, Sudbury and Rainy River. The International Nickel Co. and The Mond Co. exhibited chalcopyrite, pyrrhotite, nickel, copper matte, and refined nickel. Iron ore from the Helen Magpie Mines was shown by the Algoma Steel Corporation. Ontario lead, zinc and molybdenum ores and concentrates were of special interest. The refineries at Thorold and Deloro had sent samples of metallic nickel, cobalt, oxides of these metals, arsenic and stellite. Canadian ferro-molybdenum, ferro-silicon and ferro-mangnaese were shown. Among the non-metals were sulphur ore, salt ānd its products, barite, corundum ore, talc, gypsum, graphite, feldspar, mica and peat. The Standard Iron and Chemical Company had sent also a number of their products including euxenite, a radio active mineral. The American Cyanamid Co. of Niagara Falls, Ont., also had a line of their products in this booth.

The Groch Centrifugal Flotation Co., Ltd., Cobalt, Ont.

This company had a working model of their system going every day. The machine consists of a number of centrifugal impellers operating in a V-box divided in two ways by partitions so arranged as to give the pulp a zigzag course in two directions while going through the machine. The impellers combine the functions of centrifugally agitating the pulp, diffusing the oil, and sucking air into the mass during agitation, all accomplished in one operation.

Lignite Furnace and Straw Gas Generator

Under the enthusiastic direction of Prof. McLaurin, of the University of Saskatchewan, this exhibit made a very excellent impression on all those who examined into its possibilities. The lignite furnace is a compact little fellow that is timed to burn anything that ever was called lignite and get the best out of it. It is self-feeding and of such capacity as to need attention about twice in twenty-four hours. Coming out as it does at a time when the seriousness of the fuel supply is of national importance, the possibilities of this form of furnace construction should be most carefully considered. The main features of the furnace are: (1) A carbonizing chamber, (2) A combustion chamber, (3) Means for directing the course of hot gases, (4) Inclined shutter grate, (5) Dumping grate allowing dumping of ash and retaining of live coals, (6) Rear arch, placed at sufficient distance and inclined from fuel bed. This tends to reduce clinker formation, (7) Complete combustion provided by mixing of hot gases and hot air. There seems to be no possible danger of explosions, and the furnace is simple in its operation and control. The straw gas generator is a



NEW LIGNITE FURNACE

much bigger proposition and should be of value to the larger farmers of the West. It consists of a brick furnace, scrubber and tank designed to produce a gas for heating, lighting and power purposes. One ton of straw is estimated to give 12,000 cubic feet of gas and 600 pounds of carbon residue. The heating value of straw gas is approximately 400 B.T.U.'s per cubic foot.

Department of Interior, Mines, Ottawa

The Representatives of these departments were present to give information relative to the water power possibilities and mineral resources of various districts in Canada.

Buffalo Foundry & Machine Co.

There were indeed many striking exhibits of American firms. The Buffalo Foundry & Machine Co. as usual had a big display. Their Hough Patent Nitrator for T.N.T. takes a charge of 25,000 lbs. of mixed acids and 2,500 lbs. of toluene, and the one in exhibition was said to be only their "medium" size. It takes just thirty minutes to run this toluene into the acid. By means of a spray and circulating device every pound of toluene meets 2,500 lbs. of acid. The variation in temperature is never greater than one-half degree C. between the point of contact of toluene and acid and centre of the machine. The temperature starts at 50 degrees C. and produces dinitro-toluene at first. The cooling system is then shut off. The heat of reaction rapidly runs the nitrator up to .110 degrees C. After three hours at this temperature about 5,300 lbs. of T.N.T. is produced, being about 85 per cent. of the theoretical yield. The whole machine when running is insulated with three inches of asbestos. The water is sucked through the coils and passes an automatic acid indicator. This insures the immediate detection of any leaks and at the same time does not interfere with the reaction before any particular coil may be shut off. Over 30,000,000 lbs. of T.N.T. have been made by this machine in the last two years. The Buffalo Foundry people along with a host of other firms, have certainly responded to the call for more chemical machinery for war purposes in a most enthusiastic manner and in the least time possible.

Valley Iron Works, Williamsport, Pa.

The Valley Iron Works had reduced sizes of their "Valleiron" apparatus. A special line of autoclaves for chemical and explosive industries were shown in capacities from 2¾ quarts to 5½ gallons, and for pressures varying from 700 to 1,000 lbs. per sq. inch. Machines are complete units fitted with driving and stirring attachments and built both for direct firing or fitted with steam or oil jackets. They also build a complete line of chemical machinery in commercial sizes up to 5,000 gallons in capacity.

General Ceramics Co.

Progress in their lines since the war in stoneware pumps, exhausters, etching machines, and acid elevators. Both large and small shapes were shown. This company produces some of the largest stoneware vessels in America. A model of the Valentiner Nitric acid installation at present adopted both here and in Europe by many firms was shown.

Baltimore Cooperage Co

The Baltimore Cooperage Co. had the most varied and interesting exhibit in the line of wooden tanks for the chemical industry. The exhibit included samples of the following: taper bottom tanks, auto truck tank, railway tank, railway car tank, acid tanks, without metal parts, agitator and mixing tanks, cone bottom tanks for solids and liquids, concave bottom tanks, wooden tumbling barrels of various shapes. They also had a sample of rectangular tanks provided, with trusses to prevent bulging, and models were shown of the company's towers for various purposes. The company make some items for warships, including water breakers for submarine chasers.

Tolhurst Machine Works

This company has also contributed much to the rapid production of munitions by the development of new types of centrifugal machines. Their latest type is a suspended machine with a bottom discharge and 40 in. basket built for specially hard usage. Another recent type is the open-top centrifugal. Five types were shown with standard self balancing features. This firm has supplied some 32 different classes of industries engaged in war work with their centrifugal machines.

Ruggles-Coles Engineering Co.

A special model of a double-shell direct heat dryer was shown. Complete diagrams of their direct heat, indirect heat and steam dryers showing different installations and various types of manufacture completed the exhibit.

Bayonne Casting Company

Canadian nickel fabricated into castings of many shapes were shown. Castings and rods for chemical apparatus, retorts, washers, tubes, sheets and in general for any material subject to corrosion, were on exhibition, made from their special monel-metal.

United Filters Corporation

The well known Kelly & Sweetland filters were demonstrated here along with a model of the American Continuous Suction Filter. Sweetland's Patent Metallic Filter Cloth was also shown.

Kalbperry Corporation

Demonstrating new developments in their methods of all-masonry construction for Glover, Gay Lussac, and Denitrating Towers.

Herold China & Pottery Company

A good demonstration of Coors Porcelain, made in America —showing special tests over ranges of temperature.

Whatman Filter Papers

British-made papers of all grades for every filtering need was the slogan of this company. Although no great noise has been made about it, filter papers have come a long way towards perfection, since the first efforts of some American and British firms.

The Pfaudler Company

The Pfaudler Co. gave a fine exhibit of acid-resisting glass enamel ware, and glass lined steel tanks. This material has

stood up against the moist exhaustive tests, and one tank at the show had been handling boiling inorganic acids for over a year without injury.

Maurice A. Knight Co.

All kinds of acid proof tile, rings, bricks and tower packing as well as a line of chemical stoneware apparatus, were demonstrated.

Luzerne Rubber Co.

Showing hard rubber piping, fittings, buckets, for handling acid and alkaline solutions. Many items of interest of the chemical trade in these lines were shown.

The Mendleson Corporation

Alkali products have been in constantly increasing demand for some time. This company has greatly expanded its business in the last few years and carries full stocks of Caustic Soda, Lye, Soda Ash and Chlorinated Lime. These stock chemicals are a first necessity both in peace and war.

The Palo Co.

Continuous demonstrations in the use of one of their specialties, The Hess-Ives Tint Photometer were given. A complete line of laboratory apparatus and chemicals was shown as well.

The leading color and dye producers had some of the most magnificent exhibits of the whole show. Samples of cotton, silk and wool in every conceivable shade were arranged around the booths.

Every exhibit had a message and all more than repaid attention and study. Synthetic organic and condensite products were a multitude by themselves. The usual "tree" methods, with samples of products, were used by companies interested in coal tar distillation and industrial alcohol. Standard and novel lines in all sizes of chemical glassware were shown. The whole show was sparkling with interest to everyone, movement and color.

There were many visiting Canadians there. Many more Canadians were present who have been connected with American firms for some time. They have more than made good in many instances. The CANADIAN CHEMICAL JOURNAL was glad to be able to offer the hospitality of its booth to many of these. There was a feeling among them all that Canada had a mission at the Exposition too. We hold the keys to many things of value in our own country and in the give and take of future trade developments should guard our heritage from undue exploitation by all the means in our power. The business men in the chemical world of the United States realize, some of them even better than we do, the great possibilities for development right here in Canada.

In all respects the Fourth National Exposition of American and Canadian Chemical Industries was a success far beyond the most sanguine expectations of those interested in its promotion. It graphically illustrated the marked strides that the chemist in this country has made during the past few years; it showed the generous and unselfish co-operation that the chemist as an individual and the chemical industry in its entirety have extended to the Government in the promotion of its war activities. The record-breaking attendance that marked the exposition proved the closer relationship that now exists between the public and the chemist. The display also brought into contact the banker, the manufacturer, the business man and the chemist.

The New York display was truly a war time exposition of chemical and chemical manufacturing achievements in furthering the Allies' war making activities. For this reason, the exposition probably exceeded in importance and in its broad relation to the world's welfare any similar industrial exposition ever held, due to the fact that chemistry, in a greater or less degree, enters into every industry and is playing a deciding part in gas warfare.

We were glad to record the names of as many Canadians as we could whom we came in contact with at the big show. Some we may have missed, but the following we noted: Dr. Howard, Carlton Place, Ont.; Prof. J. W. Bain, Canadian War Trade Mission, Washington, D.C.; Dr. Bates, Forest Products Laboratory, Montreal, Que.; Arthur Buisson, Mines Branch, Ottawa, Ont.; Thomas McDougall, Montreal, Que.; Mr. Kallin, Montreal, Que.; J. C. King, Montreal, Que.; H. E. Mussett, Montreal, Que.; V. G. Bartram, Montreal, Que.; G. Frost, Trenton, Ont.; W. K. McNeill, Provincial Assayer, Toronto, Ont.; W. R. Rogers, Bureau of Mines, Toronto, Ont.; Thos. W. Gibson, Deputy Minister of Mines, Toronto, Ont.; L. W. Doncaster, Ault & Wiborg Printing Ink Co., Toronto, Ont.; Dr. A. B. Macallum, Advisory Research Council, Ottawa, Ont.; Dr. R. F. Ruttan, Advisory Research Council, Ottawa, Ont.; Dr. A. W. G. Wilson, Mines Branch, Ottawa, Ont.; John McLeish, Mines Branch, Ottawa, Ont.; Wyatt Malcolm, Mines Branch, Ottawa, Ont.; Mr. Wade, Mines Branch, Ottawa, Ont.; R. D. McLaurin, University of Saskatchewan, Saskatoon, Sask.; J. B. Davis, Stoney Creek, Ont.; Robt. Brownlee, Toronto, Ont.; H.A .Crown, Brantford, Ont.; C. H. Robinson, Ottawa, Ont.; Gerald Fitzerald, British Ministry of Food,; Prof. J. C. Fields, Toronto, Ont.; G. H. Thomlinson, Niagara Falls, Ont.; G. F. Allen, Hoyt Metal Co., Toronto, Ont.; John Hedalen, St. Catharines, Ont.; T. E. O'Reilly, Toronto, Ont.; W. Fawcett, Montreal, Que.; J. C. Platts, F.I.C., Chief Chemist, Armstrong Whitworth of Canada, Montreal, Que.

INDUSTRIAL NEWS

The Canadian Cartridge Company has begun the erection of an addition to their plant on Sherman Ave., North Toronto, to cost $40,000.

Dr. R. D. McLaurin, of the University of Saskatchewan, has been appointed consulting chemist for the recently-organized firm of Parkhill & Hanson, Limited, power and fuel engineers, Winnipeg.

On the 5th inst. an explosion caused by a leakage of gas, damaged the works of the London Head Light Gas Co., London, Ont., to the extent of $50,000.

A. E. Osler, Toronto, has been appointed liquidator for the North American Chemical Co., of Clinton, Ont. The assets are nominally $80,383, and claims against the company about $70,000.

A part of the plant of the Consolidated Mining and Smelting Co. at Trail, B.C. was destroyed by fire early last month. The damage is estimated at about $50,000. It is the intention of the Company to rebuild immediately.

The Parker Pulpwood and Timber Co., Montreal, have increased their capital stock from $49,000 to $200,000, and the name of the company has been changed to the Continental Wood Products Co., Limited.

Mr. Lucius E. Allen, C.E., consulting engineer, Belleville, Ont., has been appointed consulting engineer to the Nitrate Division, Ordnance Department, United States Army. Mr. Allen will hold the rank of captain and will be in charge of very important work in connection with war activities.

New interest has been aroused recently in the talk that there is likely to be an amalgamation of Dominion-Scotia steel interests. It is just possible that this old idea may yet be realized. In any event, a general re-arrangement of steel interests is reported as a possibility in the near future.

The British Columbia Sugar Refinery at Vancouver is erecting a heating and power plant in which pulverized coal will be used as fuel instead of foreign oil as now employed. The outcome of this experiment is being awaited with interest by many large consumers in British Columbia. The plant will be in operation about November.

Under the direction of W. J. Fielding, President, and P. L. Brown, Secretary, it is reported that the Allied Drug Co. (a new corporation) has purchased property in Port Hope, Ont. They expect to emply a staff of about 70 and to enter immediately into the manufacture of drugs and pharmaceuticals for domestic purposes and export.

RECOVERY OF VAPORS FROM COAL GAS*

By Harold S. Davis, M.A., Ph.D. (Lecturer on Chemistry in University of Manitoba), and Mary Davidson Davis.

(Concluded from September Number.)

The addition of the toluene (mol. wt. .92) will also lower the average molecular weight of the solution in which the benzene is dissolved, thereby increasing the possible concentration of benzene. Similar considerations apply to the small quantities of high boiling compounds which exist in the gas and which are soluble in the oil. These factors would result in a steady slow increase in the amount of the total hydrocarbons absorbed, over a comparatively long period.

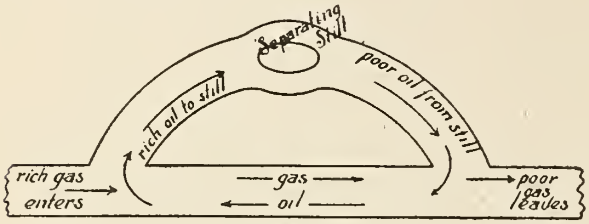


Fig. 1

To test these conlusions, the following experiments were carried out:

I. Two flasks were filled with known weights of absorbing oil and illuminating gas was passed through them for a period of two months, the gain in weight being recorded daily.

II. Two flasks filled with absorbing oil were connected in series to the gas supply and the gain in weight of each recorded at certain equal intervals.

In the case of I. the following results were obtained:

(a) The curves plotted to represent the gain in weight of the flasks rose quite sharply at first, then gradually fell off. At the end of the time the greatest gain in weight of the oil was 5 per cent., with the curve still rising.

(b) After the curves began to fall off, due undoubtedly to the fact that the benzene was no longer being absorbed from the gas, they began to fluctuate with changes in atmospheric pressure. A low pressure would lessen the amount of benzene in the gas, so that the oil would give up some of its benzene to the gas. When this amount was greater than the amount of higher boiling compounds still being absorbed from the gas, the result was a loss in weight of the oil. The same result would follow a rise in temperature of the absorbing flasks.

In the case of II. the results were:

(a) The second flask did not begin to gain in weight until there was a perceptible vapor pressure of the light oils from the first flask.

(b) When the pressure on the second flask was increased, an immediate gain in weight was recorded. When the extra pressure was taken off, the weight immediately fell off again.

To sum up, our experiments showed:

1. Equilibrium was closely maintained between the vapor pressure from the oil and that from the gas, although the washing was not particularly efficient.

2. The oil continued to gain in weight long after it had reached its maximum benzene content, and this increase in weight continued over a very long period.

The Extraction of Toluene Only from Coal Gas

The shortage of toluene and the over-production of benzene have brought up in this country the question raised some time ago on the continent as to whether it is possible to obtain all the toluene from the gas without extracting all the benzene. As has been pointed out already, it is theoretically possible to extract any of the constituents from the gas, provided the proper amount of oil is used.

In any washing system the absorption process is really selective, some of the constituents being wholly extracted, others only partially. The rich oil is always saturated with respect to the latter. Since the vapor pressure of toluene in the gas is considerably less than the vapor pressure of benzene, it follows that much less oil is required to completely remove the toluene than to completely remove the benzene. It is only necessary to have that quantity of oil which will give a vapor pressure of toluene equal to that in the rich gas. This quantity of oil will also remove all the xylenes and other high boiling constituents, but will only partially extract the benzene.

Experiments conducted at absorption plants, however, have shown that if the flow of oil is much below that required to merely extract all the benzene, the toluene yield of the plant is decreased. The following reasons may be given for this decrease in the yield of toluene:

1. If the scrubbing system is inefficient, a considerable excess of oil over the amount theoretically required is necessary in order to provide a solution gradient for the toluene, as previously described for benzene.

2. The steam stills for separating the light oils may not be efficient and may leave a certain vapor pressure of toluene in the poor oil. As has already been pointed out in the case of benzene, the proportion of toluene lost will be in the direct proportion of the vapor pressure of toluene from the poo oil to that in the rich gas. Now the time occupied by any quantity of oil in passing down the steam still is fixed, as is the amount of heating and the quantity of steam to which it is exposed. We may therefore assume that as the amount of toluene in the rich oil is decreased, the amount left in the poor oil will also be decreased. Hence, with an excess of oil, the poor oil coming from the still will contain but l ttle toluene, so that the amount left in the poor gas will be correspondingly small. The result is a comparatively high yield of toluene. The steam distillation still is, therefore, a very important part of a light oil recovery plant; nothing can compensate for its inefficiency.

A New Method for the Quantitative Estimation of Vapors in Gases

A great need has been felt by those engaged in the commercial production of light oils, for methods of gas analysis requiring only small samples and giving a rapid estimation of the content of these vapors either collectively or individually. Such methods would make it possible to find the conditions of production necessary to obtain the maximum concentration of each aromatic substance and would also permit the efficiency of absorption processes to be checked at every point.

Methods at present employed require the absorption of the light oil vapors from the gas over a comparatively long period, so that the results represent the average values for this period. Such a method is wholly unsuitable for checking the efficiency of the different parts of the washing system, since conditions such as the rate of flow of the gas, its composition, the temperature of the washing towers, etc., are continually changing.

We have developed a new method for the quantitative estimation of vapors in gases, which requires only a small sample of gas, 150-350 c.c. and which can be carried to completion in one-half to one hour.

Theory of Method

It is a generally accepted principle that the vapor pressure from a liquid is independent of the kind of gas above it, provided the gas is inert. Deviations from this law are well known, but it holds with surprising accuracy in the case of a mixture of benzene and air at atmospheric pressure.

Consider two closed flasks, as in Fig. 2, connected by a manometer and filled with air at atmospheric pressure. If now a small sealed bulb containing a volatile liquid be broken in each, the

* Taken from Report No. 2, issued by Honorary Advisory Research Council, Ottawa, Canada.

liquid will partially evaporate, and if the temperatures of the flasks remain the same, the same additional pressure will be developed in each, so that the manometer connecting them will register no difference in pressure. Even if the temperatures of the flasks do vary, no difference in pressure will be recorded until there is a relative difference in temperature between them.

Now suppose that one of the flasks had contained a certain quantity of the vapor of the volatile liquid corresponding to a pressure less than the saturation pressure. When the small bulb of liquid was broken in this one, the liquid would not add all its vapor pressure to the pressure already in the flask, for part of that was already due to its vapor. It would add only the amount of pressure necessary to bring its pressure up to saturation; and since the total saturation pressure was added to the pure air in the other flask, the manometer connecting the two would register a pressure equal to the pressure of vapor in the original gas.

1. Each of the sealed bulbs must contain considerably more liquid than is required, at the temperature of the experiment, to saturate the atmosphere of the flask into which it is broken, with the vapor in question.

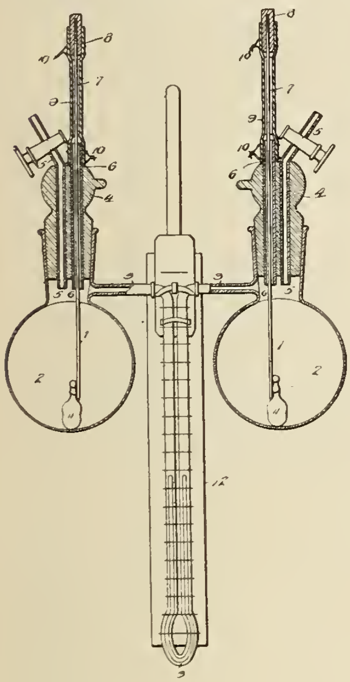


Fig. 2.

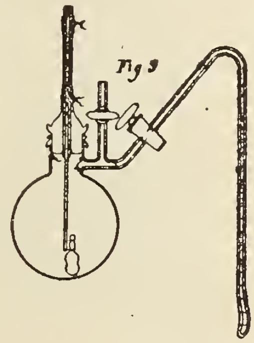


Fig. 3

2. It is essential that the substances remaining in the bottoms of the flasks after the bulbs are broken shall have the same composition and shall give the same pressure of the vapor in question, and that this pressure shall be greater than the original pressure of the vapor in the gas.

3. A solid can be used in the bulbs in place of a liquid, if the substance exists as a solid at the temperature of the experiment.

4. A solution can be used in the bulbs containing the liquid of the vapor to be measured, provided there is sufficient of this liquid to give us pressure greater than the pressure in the gas. A solution will offer advantages over the pure liquid if less total pressure is developed from it, so that the danger of leakage in the flasks is decreased. Further, if a solution is used which gives partial pressures of two or more separate substances, and if these substances were contained in the original gas as vapors, then the differential pressure developed between the two flasks will be equal to the sum of the original partial pressure of the vapors in the gas.

5. The partial pressure of any particular vapor in a sample of gas is independent of the temperature of the gas, provided that the total pressure on the gas remains constant while the volume can change with the temperature, and provided the vapor remains always unsaturated and obeys the simple gas laws. An apparatus constructed on this principle, will, therefore, measure a definite quantity, viz., the pressure of the vapor in a gas at atmospheric pressure. This measurement can easily be reduced to standard pressure.

6. Though the partial pressure of a vapor is independent of the temperature, the actual weight of the vapor contained in unit volume of the gas depends on the temperature. For one vapor, this weight may be calculated from the partial pressure, on the assumption that the vapor gives the same partial pressure as it would if it were a true gas at that temperature and molecular concentration. In the case of two or more vapors, the actual weight of each vapor cannot be so calculated, unless the relative proportions of the vapors are also shown. This, however, does not impair the usefulness of the method for comparative tests on the total quantities of several vapors, e.g., light oils, in different samples of gas.

Experimental Part

The apparatus used is of the form shown in Fig 2. Details of the apparatus can be obtained by reference to Paper No. 2 listed in the Preface.

The essential features are:

1. Two compensating flasks connected by a manometer.

2. That these flasks be air tight, but that they can be opened to atmospheric pressure.

3. That where the flasks are closed the bulb of liquid (or solid) can be easily broken.

A modified form of apparatus is shown in Fig. 3. This form is so arranged that the flasks are close together and the manometer tube is led out from them, so that they may be placed in a bath of any kind, while the manometer remains outside.

The procedure is as follows:

(a) Attach the bulbs filled with the desired liquid (or solid).

(b) Evacuate the flask, which is to be filled with the gas sample, i.e., the flask on the same side of the manometer as the stop-cock. We have evacuated by means of a water pump, which rapidly reduced the pressure to less than 1 cm. of mercury.

(c) Fill this flask with the gas sample and close the outlet stop-cock. We have found small gas holders (about 300 cc.) with stop-cocks at both ends most satisfactory for collecting gas samples. The gas is displaced from them into the apparatus by means of mercury. Samples of gas should not be allowed to stand over water, as the solubility of the light oils in water is quite large for small samples of gas.

(d) Let the apparatus stand until equilibrium is reached. Open the stop-cock in the manometer, equalize the pressures by bringing each flask to atmospheric pressure. Close both outlets.

(e) Break the bulbs, preferably the one on the gas side first, as the pressure will develop the other way.

(f) Let stand until equilibrium is reached; 10-15 min. and 30-60 min. for flasks of 150 and 350 cc. capacity, respectively.

(g) Clean and dry the apparatus. We have done this by drawing warm air through each side.

Considerable care must be taken with blowing the bulbs, which must have thin bottoms. A person with ordinary laboratory technique, however, can easily prepare a large number in a short time. Details of the procedure we found most satisfactory are given in Paper No. 2.

While determinations can be made quite successfully in a room moderately free from draughts, more accurate work requires a water bath, kept stirred. For the latter, the modified form of apparatus is required.

Efficiency of the Method

In order to check the method we ran a series of experiments in which different known quantities of benzene in air were estimated. The results were very satisfactory, the average agreement of the known and measured values for thirteen experiments being within 1.5 per cent.

When, however, the air contained toluene vapor in addition

to the benzene, it was found that the toluene rapidly dissolved in the liquid benzene in the bottom of the flask. As a result the differential pressure recorded was not the pressure of benzene, but the pressure of benzene and the pressure of the toluene dissolved out. If sufficient liquid benzene was used, all the toluene dissolved out and the differential pressure then represented the sum of the benzene and toluene pressures in the original sample of air.

It was found experimentally that any one of the following liquids used in the bulbs gave the total light oil content of illuminating gas, the results agreeing satisfactorily.

1. Benzene only (under certain conditions).
2. A solution of equal volumes of benzene and toluene.
3. A solution of equal volumes of benzene, toluene and xylene.

In the first case, the toluene and xylene from the gas dissolve in the benzene. In the second case, the pressures of both the toluene and benzene from the solution are greater than their original pressures in the gas, and they are estimated by the same principle. In the third case all three vapors are estimated in this way.

The Estimation of the Benzene Content of Coal Gas

It has already been pointed out that the amount of benzene in a sample of air can be accurately determined by the differential pressure method, using bulbs of liquid benzene. On the other hand, when the sample in question is illuminating gas, which also contains toluene and other light oils, the following factors must be considered:

1. The toluene and other light oils dissolve in the liquid benzene so that their pressures are almost entirely removed from the gas, while at the same time, these dissolved substances lower the vapor pressure of the benzene.

2. A less serious error is caused by the gases other than the light oils dissolving in the liquid benzene.

In order to eliminate these sources of error, we have conducted investigations on gases by the differential pressure method, using bulbs filled with solid benzene, and immersing the apparatus in a bath below the freezing point of benzene, 5.48°. It is well known that the solubility of permanent gases in a solid, such as frozen benzene, is vanishingly small, so that the second source of error mentioned above is completely removed.

Again, the vapor pressure from the solid benzene is, at any fixed temperature, independent of the solution by which it is surrounded, so that while the solid benzene is present at equilibrium there can be no lowering of the vapor pressure.

The experiments were highly successful. It was found possible to determine the benzene content of a gas in this manner with considerable accuracy, even when fairly large quantities of toluene and xylene were present in the gas.

It is quite easy to keep a bath for the apparatus at a temperature near 0° with ice and water. The chief difficulty we experienced was in freezing the small bulbs of benzene, for they could be enormously supercooled. The best method is to freeze them in the escaping stream of liquid and gas from a carbon dioxide cylinder. Once frozen, they are of course quite stable for several degrees above zero.

As far as we know, this is the only method by which the benzene content only can be found accurately in a small sample of gas which contains also its homologues.

Contents of the Rich and Poor Washing Oils

In order to measure the vapor pressures of the light oils from the rich and poor washing oils, we have used two methods:

1. A small amount of air was shaken up with a large amount of washing oil until equilibrium was reached. The quantity of oil must be so large that its concentration of light oils is not appreciably affected by the amount which evaporates into the air. The air was then drawn into a differential pressure apparatus and analyzed for its total light oil content.

2. About 5 g. of the oil was sealed up in a thin bottomed bulb. The bulb was then placed in a differential pressure apparatus whose flasks had a small capacity. After equilibrium was reached, the bulb was broken and the pressure ot light oils from the washing oil measured directly.

By means of these measurements and those previously described in this paper, a close check can be kept on the efficiency of the washing system, and the steam distillation stills of a light oil recovery plant, and this in general will lead to an increased production.

Conclusion

It is possible that the methods outlined in this paper may be of use in other fields besides light oil recovery. In natural processes and in many industries it often happens that large quantities of gas mixtures are produced which contain the vapors of valuable liquids. Thus natural gas often contains as vapors quantities of the substances which constitute gasoline, while methyl alcohol and acetone vapors exist in the gases given off during the destructive distillation of wood. The method may also prove useful for the quick estimation of the water content of air.

Finally, it is hoped that by this method of analysis it will be possible to obtain more precise knowledge concerning the effect of conditions of coking on the production of light oils. We have done some preliminary work on the variation of the light oil content in illuminating gas with the different stages of coking, but extensive research with good equipment is needed in this field from which so much information of great economic value is still to be obtained.

Clifton, Colchester Co., Nova Scotia.

CANADIAN FERRO-CHROMIUM

The production of another ferro-alloy is about to be undertaken by a Canadian firm. The electric furnace industries have certainly made rapid strides in the Dominion during the last few years. Chromite has become a necessity to the steel industry, and appears in the form of "chrome steels" and refractory linings of blast furnaces. Much Canadian ore has been previously sent to Niagara Falls, N.Y., and to Pennsylvania plants. When ocean transportation was cut off the Quebec ores began to receive much more attention. The price of chrome ore went from around $14 to $45 a ton. The new plant, it is stated, will be put up at Cordona Mines, Peterborough County, Ont., and is expected to be in operation in a very short time, with an initial capacity of two to three tons per day. The Cordona Mines, Ltd., a well known gold mining concern, are behind this move and will use 1,200 horse power from Deer Lake on their new venture. The 1918 estimates of the United States for chromium calls for 130,000 tons of 50 per cent. ore. About 65,000 tons of this goes into ferro-chromium. Some 40,000 tons goes to bichromites and chemicals, while 20,000 is used for refractory purposes. The present price of ferro-chromium is about $100 a ton. Several grades are made, depending on the carbon content. The alloy may have from 25 to 75 per cent. chromium and from 2 to 8 per cent. of carbon. Very hard cutting tools and armor plates may contain from about 2 to 4 per cent. of chromium. Nickel chrome steels have many uses and should become the basis of a Canadian industry. Nickel and chromium, together greatly increase the strength and resistance of steels. This move on the part of a Canadian firm marks a distinctly new step in the building up of a chain of very important electric furnace industries in Canada, and opens a wide field for the development of many valuable sidelines.

The British Cellulose Co., makers of a non-inflammable "dope" for aeroplanes, propose to erect a Canadian branch plant similar to their branch in New Jersey. Sir Sam Hughes states that its capital has already been provided for. After the war the composition can be used in several industries, including picture films, silk manufactures, furniture lacquering, window panes, etc.

CHARLES F. ROTH

The great nations of Europe had not been at war many weeks before the people of the United States realized the need of self-dependence in the chemical products which for many years had been developed under foreign control. The idea of an exhibition which would be the means of home education for the people and for the industries, without which the business of the country could not be carried on, soon took shape, and men like Dr. C. H. Herty, Dr. Leo H. Baekeland, Dr. M. C. Whitaker, Dr. T. B. Wagner, Dr. E. F. Roeber, Dr. B. C. Hesse, Dr. A. D. Little, Henry B. Faber, R. P. Perry and many others warmly encouraged the plan. While these gentlemen lent the weight of their authority

MR. CHARLES F. ROTH

to the idea of a combined convention and exhibition, it required born crusaders like Mr. Charles F. Roth and Mr. F. W. Payne to stir up an enthusiasm, and bring the leading manufacturers together. Being himself a chemist, Mr. Roth knew where to go and whom to see, and by addressing meetings of chemists and groups of manufacturers, his propaganda met a remarkable response in the first chemical exposition of 1915. The attendance was large and there was an intense interest in the show on the part of the general public and the press, which has not relaxed since.

Mr. Roth was born in 1886, and after a public and high school education in New York, entered Cooper Union for a five year course. After graduating there in chemistry, he took a post graduate course in metallurgy and metallography and obtained the degree of Bachelor of Chemistry. He then entered the National Brewers' Academy and spent four years in the study of fermentations and in work on grains, sugars and starches. Three years were devoted to oils, fats, waxes and petroleum in the laboratory of the Standard Oil Co., associated with Gail Merseream. Afterwards he studied chemical engineering and chemical equipment, gaining a knowledge which enabled him to interest makers of equipment in the exposition. He also had the advantage of dealing with men as a plant manager, having been secretary and manager for the Keep Manufacturing Company, as control chemist at the National Brewers' Academy, as manager of the Hartford Cast Stone Co., and for a year as chief chemist for the Standard Oil Co.

Mr. Roth is a member of the American Chemical Society, the American Electrochemical Society, and is on several important committees of these societies, including the publicity committee. He is also a member of the Société de Chimie Industrielle, the reorganized French society, and is sec.-treasurer of the New York section of the American Chemical Society. He has the honor of being on the Perkin Medal Award Committee, the Nichols Medal Award Jury, and last but not least, the committee of the society appointed to co-operate with the United States Government in war work. To the surprise of many outside friends, Mr. Roth appeared in khaki at the exposition, a token that his services had been required by the Government. Mr. Roth's official address is, in fact, already changed from New York to Washington (1346 Quincy St. N.W.), and while it does not appear what his duties are, it is certain that the knowledges he possesses of local conditions and capacities of the chemical and metallurgical industries of the United States will fit him for any task demanded of him by the Government in making most of the national requirements for war purposes.

RECENT INCORPORATIONS

Toronto.—The Marvel Drug Co., Ltd. Wm. H. Kirkpatrick, solicitor. Capital $20,000. Chemicals and medicinal preparations.

Toronto.—United Cheese, Limited. Andrew Wentworth Hunter, solicitor. Capital $1,000,000. Chemists, druggists, chemical manufacturers and analysts, and dairy products.

Ottawa.—Merkley's, Limited. Ainslie Wilson Greene, solicitor. Capital $150,000. Pulpwood, clay, oil, terra cotta, etc.

Montreal.—Canadian Johns-Manville Co., Ltd. Gordon Walters MacDougall, solicitor. Capital $2,500,000. Asbestos, minerals, metals and by-products of same. (Re-incorporation.)

Orillia.—Electric Iron, Limited. Melville B. Tudhope, solicitor. Capital $45.000. Metallurgists, mechanical and electrical engineers.

Montreal.—Canadian Crude Asbestos and Fibre Corporation, Ltd. Alex Huntley Duff, solicitor. Capital $20,000. Ores, metals, and minerals.

Montreal.—Canada Chemical Works Co., Ltd. Raoul O. Grothe, manufacturer. Capital $50,000. Chemicals, medicinal preparations, coal-tar products, ores, metals and minerals.

Dryden.—Dryden Pulp and Paper Co., Ltd. Capital $1,000,000. Mechanical and chemical pulp and paper. (Re-incorporation.)

Toronto.—Castle Oil and Gas Co., Ltd. M. Lockhard Gordon, solicitor. Capital $1,500,000. Oils, ores, metals and minerals.

Toronto.—Dundas Oil and Gas Co., Ltd. A. & M. Levitt. Capital $500,000. Ores, metals, minerals, oils and gas.

Toronto.—Gold Lake Mining Co., Ltd. Emerson T. Coatsworth, solicitor. Capital $1,000,000. Ores, metals and minerals.

Wingham.—The Farmers' Fertilizer Co., Ltd. Thos. Taylor, analytical chemist. Capital $50,000. Fertilizers.

INDUSTRIAL NEWS

The Whalen Paper and Pulp Mills, Ltd., have recently shipped from their Port Alice plant (on Quatsino Sound) 150 tons of high-grade sulphite wood fibre, which is the first pulp ever manufactured on Vancouver Island. At present the plant provides for an output of 65 tons of pulp per day, and employs about 700 men.

The publishers of the Canadian Mining Journal, 263 Adelaide St. West, Toronto, are now preparing a new edition of the Canadian Mining Manual, which has now become such a valuable work of reference on mining matters. The space devoted to "war minerals" will be increased, and other new features will be added. We may be sure that anything undertaken by its editor, Mr. Reginald E. Hore, will be well done.

The town of Niagara Falls, Ont., offers an opening for a new chemical or metallurgical industry in a building with six acres of land. The building was designed for experimental purposes and has railway sidings and all conveniences including Niagara Falls

power. Particulars may be had of the Secretary of the Board of Trade, as announced in advertisement in this issue.

According to a recent announcement, the munition plant at Leaside, Toronto, is to be enlarged at a cost of at least $3,000,000. The plans call for the erection of two buildings of brick and steel construction—one 280 ft. long, the other 640 ft. 500 workmen are already employed. The new building will be devoted entirely to the filling of an order for 12-in. shells for the U. S. War Department.

Two large beds of fire clay have been found by Capt. C. M. McCarthy, of Elk Lake, Ont., and have received a very favorable report from the Department of Mines. These beds are on the Mattagami River near Long Rapid. A test of the clay shows no deformation at a temperature of 3254 deg. F. The shrinkage in drying is small, and the working qualities are good, though when the temperature exceeds 2400 deg. F. small black specks develop, due perhaps to iron. This is the first find of a No. 1 fire clay in Ontario.

The installation of machinery in the new Haileybury Mining School is nearing completion. The entire equipment, inclusive of building, is estimated at a value of about $3000. The building is located in close proximity to the Cobalt silver mining area. Thirty-five pupils are already enrolled and among the members of the teaching staff is Mr. J. Hill, M.A., B.S.A., instructor in chemistry, metallurgy, mineralogy and physics. Mr. Hill is a graduate of Queen's University, and for about four years was editor of the Dominion Geological Survey at Ottawa, previous to which he was in charge of the assay and refining department of the Deloro Smelting & Refining Company.

PERSONALS

Capt. Alan Sullivan, of Toronto, poet, novelist and engineer, is recovering from an airplane accident received in a flight from Leaside to Cobourg, Ont.

Mr. Lucius Allen, of Belleville, Ont., formerly engineer for Hastings County, has been appointed consulting engineer to the Nitrate Division of the U. S. Ordnance Department, with the rank of captain.

Mr. Leslie R. Thomson, B.A.Sc., A.M.E.I.C., the able secretary of the Honorary Advisory Council for Scientific and Industrial Research, has also accepted a position with the Lignite Utilization Board in Montreal.

Mr. S. J. Cook, Mr. Ross E. Gilmore and Mr. R. Leslie Emslie have been elected members of the Ottawa committee of the Society of Chemical Industry, in lieu of Mr. Race, Mr. Stansfield and Mr. L. E. Westman, resigned.

Mr. James Beveridge, Chatham, N.B., is now with the Champion Coated Fibre Co., Canton, N.C. Mr. Beveridge is well known in Canada as a writer of technical articles and has had a large experience in the manufacture of chemicals.

Dr. Harold S. Davis has been appointed to the research staff of the H. Koppers Co., of Pittsburgh, Pa., one of the largest companies in the world engaged in the construction and operation of by-product coke ovens, benzol and toluol plants. Dr. Davis will carry on his work at the Mellon Institute.

Dr. J. B. Calkin, a distinguished educationalist and the author of several text books used in the Maritime Provinces, died at Halifax last month. He is survived by several children, one of whom is Mr. W. S. Calkin, chemist, in a Pennsylvania paper mill.

Mr. H. A. Crown, formerly chemist of the Canada Glue Co., Brantford, has returned to that city from Massachusetts, to take his old position. Mr. J. W. Coy, who succeeded Mr. Crown at Brantford, has gone to the American Glue Company's branch at Allegheny, Pa.

Mr. Edgar Stansfield, M.Sc., Chief Engineering Chemist of the Fuel Testing Plant of the Department of Mines, has been loaned by the Department to the Lignite Utilization Board, of which announcement has already been made in these columns. Mr. Stansfield will go to Montreal, where this Board has its headquarters.

Capt. Joseph Race, F.I.C., leaves for duty in Siberia with the Hydrological Corps early this month. Capt. Race was the very efficient secretary of the Ottawa section, Society of Chemical Industry, and was largely responsible for the activity of this Society here last year. He is succeeded in this office by Mr. S. J. Cook, B.A., of the Food and Drug Laboratories, of the Trade and Commerce Department.

Two of our research chemists have been granted further exemption from military service, on account of the importance of their work in Canada. They are Mr. W. A. Lawrance, Toronto, research chemist for the Toronto Carpet Mfg. Co., and Mr. Horace Freeman, of the American Cyanamid Company, Niagara Falls, Ont.

Mr. Harold J. Roast, F.C.S., of Montreal, was a visitor to Ottawa recently. It is understood that Mr. Roast was here for the purpose of furthering the interests of the Chemists' Organization Committee, of which he is the secretary. Although no definite information as to the progress that has been made by this Committee was available, it seems probable that action will be taken at an early date in connection with the organization of the chemists of Canada.

The following appointments have been made to the staff of the Department of Chemistry, University of Toronto, for the current year: Assistants, A. L. Marshall, B.A., University of British Columbia; E. I. Fulmer, M.A., Neb., U.S.A.; M. E. Smith, B.A., Fredericton, N.B.; W. R. Fetzer, B.A., Neb., U.S.A.; L. E. Westman, M.A., Toronto. Norman A. Clark, B.A., of the University of Alberta, is holding a fellowship from that institution in the Graduate Department.

The following new demonstrators have been appointed to the staff of the Chemistry Department in McGill University for the session 1918-19, namely: Mr. G. S. Whitby, A.R.C.S., M.Sc., formerly in the Research Department of the Société Financiere des Caoutchoucs, Federated Malay States; Mr. John Russell, M.Sc., of Vancouver, B.C.; Mr. C. Greaves, B.Sc., of the Barbadoes, West Indies, and Mr. W. McGregor Mitchell, B.A., of Queen's University, Kingston, Ont.

NEW CANADIAN CHEMICAL PRODUCT

Chemical Products Co., of Canada, Ltd., Toronto, announce that they are now in a position to supply the Canadian trade with ammonium chloride. Previously this was imported from the United States, and Canadian dealers were continually handicapped by long delays and the necessity for import and export licenses. The battery trade and all galvanizers should find the situation much improved. The ability to get such products on the home market relieves both the War Trade Board and the whole chemical situation generally. Such enterprise by Canadian firms is certainly in order right now.

THE MORGAN EXPLOSION

The T.N.T. plant of T. A. Gillespie, at Morgan, N.J., was blown up on the night of October 4th. Over 2,000 workmen were busy on the night shift at the time the first series of explosions took place. Morgan is near Perth Amboy, and is some 29 miles from New York City. Something of a panic was caused during the first few hours of the conflagration, but it is expected that the final loss of life will not be as heavy as at first feared. Mr. Yates, of the Gillespie Company, states that the main reserve stores of T.N.T. were not touched, as they were stored at Cheesequake Creek. When the amount of work of this kind being done, and the class of partially-skilled labor that must necessarily be employed is considered, it is rather more remarkable than otherwise, that our industrial catastrophies have been so few. Besides the natural hazard, there also remains the difficulty of continually guarding against alien enemies and their assistants.

BOOK REVIEWS

Britain's Heritage of Science. Arthur Schuster and D. E. Shipley.

In these days, when science is occupying so large a place in the education and life of the nations, a history written by Arthur Schuster and A. E. Shipley, under the title of "Britain's Heritage of Science," will be found of great interest and most readable. The writers do not claim to give an exhaustive treatise on the subject; but merely to lay stress on its salient features. The first six chapters take up physical science under different aspects—the first chapter giving a sketch of the life and work of ten of the most noted scientists, covering the period from 1214 to 1879, beginning with Roger Bacon, the Franciscan friar, Galileo, Sir Isaac Newton, Michael Faraday, Dalton and Clerk Maxwell. The second chapter deals with the development of science in the Universities of Oxford and Cambridge, outlining the career of some distinguished university men—notably, Christopher Wren, Robert Hooke, and Desaguliers—the latter a great authority on electricity. The third chapter deals with the "Non-Academic Heritage," Wm. Herschel being one of the many brilliant scientists in that class. Then follows "The Heritage of the Nineteenth Century," where, among many other distinguished names appear those of Sir Humphry Davy, Sir George Stokes, and Henry Smith—the latter one of the greatest of the Oxford professors. In Chapter VI., under the heading of "Industrial Applications," the application of chemistry to the necessities of the nation is taken up, the greater part of the section dealing with the life and work of the more eminent chemists of the day—especially those devoted to the manufacture of alkali and coal tar products, Gamble and Muspratt being two of the most prominent workers in this field. Chapter VII. is devoted to the subject of the scientific institutions, giving a sketch of the origin and career of the Royal Society. In the remaining chapters the subjects dealt with are, Biology, Botany, Zoology (Darwin's doctrine of evolution being touched upon), Physiology and Medicine, and Geology. The book contains fifteen portraits of men eminent in their particular branches of science, and is printed in clear type, on heavy paper. It should prove of great value to the reading public, reviewing, as it does, so many different avenues of approach to the scientific world. It contains 319 pages and is published by Constable & Company, Ltd., London. Price 8s. 6d., cloth bound.

Inorganic Chemistry. Horace G. Byers. Charles Scribner's Sons, New York.

No great effort is shown to break away from well-known methods of teaching this subject to junior and intermediate classes in chemistry. As it is stated in the preface, the influence of the Alexander Smith method of writing such texts is acknowledged. The extensive sale of this series probably warrants the author in assuming that another book along similar lines would meet with its fair share of favor. As a text, it covers and presents the subject well enough from the student's viewpoint. In this sense it reaches its aim. No suggestion of any distinct advance has been made by the author, however, along newer or better lines of presenting the subject. Price $2.25.

A Laboratory Manual of General Chemistry. H. G. Byers. Charles Scribners' Sons, New York.

This manual is designed to accompany the author's text on this subject. It outlines 167 experiments, some of which have been specially designed. In other respects there are no novel features.

Annual Chemical Directory of the United States. Williams & Wilkins Co., Baltimore.

The problem of designing and publishing a perfect Chemical Directory has not yet been solved. At the same time, the 1918 Edition of this Directory places in the hands of chemists, engineers, buyers and sellers of chemicals and equipment a very handy and fairly complete ready reference. The size of the volume has naturally increased since last year, and a distinct step has been made towards that theoretically perfect source of information mentioned above. The book should save much time for both the technical and non-technical user. While perfection is not to be expected in such a growing field, we have no doubt that a future edition will show improvement both in respect to the completeness of lists of manufacturers and to the expertness of the classifications. Price. $5.00.

Hand Book of Chemistry and Physics. Sixth Edition, 1918. The Chemical Rubber Co., Cleveland, Ohio.

As the title states, this little book covers a very broad field. Rather complete and very practical mathematical tables are given. These are followed by the usual constants for chemistry, both organic and inorganic. A scheme for the qualitative analysis of various inorganic groups of metals and non-metals is outlined, which should prove of value as a ready aid to the memory of the average junior chemist. Tables showing heats of formation, solubility products, and ionization constants of acids and bases most commonly met with, should prove of service.

From the viewpoint of the chemist, that portion of the book devoted to data on Sound, Electricity and Magnetism, Light and Wire measurements may not be of special value; at the same time, it should prove of considerable interest to the chemical engineer, especially that portion covering the general properties of matter. There are several hand books covering much the same field in chemistry, and many designed to be of service to the engineer. The volume should prove of special value to college students desiring a ready reference source to the fields of applied mathematics, chemistry and physics. Pocket size, soft leather cover, $2.00.

UNITY IN TECHNICAL WORK

Unity of military and naval effort by the allied nations is being extended to technical work by the various war commissions sitting at Washington, London and Paris.

Subordinate to the Inter-allied Councils there are being organized Commodity Committees or Executives. While the Inter-allied Councils are composed of men of so-called Ministerial or Cabinet position, the committees will be made up of men of lesser rank, but experts in their particular commodity.

The committees will deal with all materials and commodities used in the war. These include nitrates, tungsten and tin, international pooling agreements for which have recently been effected in Paris and London; non-ferrous metals, iron and steel, hides and leather, rubber, wool and all other raw materials or manufactured products of which there may be a shortage, or surplus. Pooling agreements for these will be effected as the necessity arises. The committees will be responsible to the five Inter-allied Councils. Any differences arising as to allocation of ships or material or other matters of a vital nature, on which the members of the Inter-allied Councils are unable to agree, will be brought to President Wilson and the Premiers of the allied nations for settlement.

Chemical problems are to be considered at the London conference to which the National Academy of Science, which has its headquarters in Washington, has appointed delegates. The meetings are to begin October 9. One of the American delegates is Dr. A. A. Noyes, of the chemical faculty of the Massachusetts Institute of Technology. The others are Dr. George E. Hale, of the Mount Wilson Solar Observatory, who is chairman of the National Research Council in this city; Dr. Simon Flexner, pathologist, of The Rockefeller Institute for Medical Research; Dr. N. A. Bumstead, professor of physics at Yale, and now scientific attache at the American Embassy in London; Dr. W. F. Durand, professor of mechanical engineering at Leland Stanford University and scientific attache at the American Embassy in Paris, and Colonel J. J. Carty, chief engineer of the American Telephone and Telegraph Company. These men are to confer with representatives of the acadamies of Paris, London, Rome and Tokio.

Chemical and Metal Markets

The Quotations below represent average prices for the quantities indicated. Larger quantities may be obtained at lower figures.

TORONTO, 12th Oct., 1918.

One of the notable decisions of the past month has been the fixing of prices of sulphuric acid by the U. S. Government, the War Industries Board at Washington having, subject to the President's approval, determined the following rates and terms, taking effect September 30th, and to continue till the end of the year.

Sulphuric acid, 60 degrees Baume, $16 per ton of 2,000 pounds. Sulphuric acid, 66 degrees Baume, $25 per ton of 2,000 pounds. Sulphuric acid, 20 degrees oleum, $28 per ton of 2,000 pounds. Prices are f.o.b. at manufacturers' works in sellers' tank cars. All strengths less than 66 degrees Baume shall be calculated from the maximum price for 60 degrees Baume. All strengths above 66 degrees Baume (93.2 per cent. H2 SO4) shall be calculated from the maximum price for 66 degrees Baume. In carboys, in carload lots, one-half cent. per pound extra. In carboys, in less than carload lots, three-fourths cent per pound extra. In drums and quantity, one-fourth cent per pound extra. Nitric acid, 42 degrees Baume, 8½ cents per pound, f.o.b. manufacturers' works in carboys. In carboys in less than carload lots, one-fourth cent per pound extra. There shall be no additional mixing charge for mixed acids, same being figured on the acidity content. The rates were decided after a meeting of makers of sulphuric acid and nitric acid.

The War Industries Board is also working out a system of contracts for traders in platinum, iridium and other war metals, to be promulgated shortly.

Nation-wide prohibition, to take effect July 1st, 1919, has been adopted by the U. S. Congress, and this will involve important changes in the alcohol industry of the United States.

Petroleum production to the utmost is being encouraged in Canada and the United States, and in addition to the appeal to the people to cease Sunday motoring to save gasoline, all large manufacturers, importers and dealers in petroleum products are being placed under license with a view to regulation and conservation. In the U. S. these regulations apply to natural gas as well. Drilling for oil and gas is being carried out in several places, in the Peace River region and in British Columbia; while official attention is being turned to the oil shale deposits of New Brunswick. The Continent of America will need over 25,000,000 or more than last year, for war and peace purposes.

By the fire, which has put out of commission, for several months to come, the plant of the Chromas Chemical Co., of Brooklyn, the production of benzoate of soda in the U. S. will

Continued on page 40

Acetanilid, C.P.	Lb.	1.10—1.20
Acetic acid, commercial, crude, 28% in bbls.	Lb.	10——10
" " 80 per cent. pure	Lb.	.35—.37
Acetone	Lb.	.50
Aspirin	Lb.	3.25
Alcohol, grain, bbl.	Gal.	8.50
Alcohol, methylated, bbl	Gal.	1.65
Alcohol, wood, 95 per cent., refined bbl.	Gal.	1.60
Alum, ammonia lump	100 Lbs.	$6.00—6.50
Aluminum Sulphate, high grade, bags	100 Lbs.	3.50—4.50
Ammonia, Aqua .880	Lb.	.16—.18
Ammonium Carbonate	Lb.	(Nominal)
Benzoic Acid	Lb.	3.80—4.00
Bleaching Powder, 35% drums	Lb.	.04—.05
Borax, crystals	Lb.	.10—.10¼
" powdered	Lb.	.10—.10½
Boric Acid, powdered	Lb.	.16½
Calcium Chloride, fused, in drums	Lb.	.01—.02
Carbolic Acid, white crystals	Lb.	.60—.75
Carbon Bisulphide	Lb.	.25—.30
Casutic Soda, ground, Bbl.	Lb.	.08—.09
China Clay, imported	per ton	$25—$30
Chloroform, com.	Lb.	1.00—1.40
Citric Acid, domestic, crystals	Lb.	1.05—1.10
Cobalt Oxide, black	Lb.	1.50—1.75
Copper Sulphate (Blue Vitriol)	Lb.	.11½—.12
Fuller's Earth, powdered	100 Lbs.	6.00
Glycerine, 56 lb. tin	Lb.	.76
Hydrochloric Acid, carboys, 180	Lb.	.03¼—.03½
Lead Acetate, white crystals	Lb.	.25
Lead Nitrate	Lb.	.18—.20
Magnesium Carbonate, B.P., bbl.	Lb.	.22—.25
Nitric Acid, 36° carboys	100 Lbs.	.10
Oxalic Acid	Lb.	.42—.45
Potassium Bromide	Lb.	2.10—2.35
Potassium Carbonate 90 to 95%	Lb.	1.75—2.00
Potassium Chlorate, crystals, Kegs	Lb.	.55—.60
Potassium Nitrate, Kegs		(Nominal)
Potassium Permanganate, bulk	Lb.	2.75—3.00
Salicylic Acid	Lb.	1.25—1.50
Silver Nitrate	Oz.	1.00—1.10
Soda Ash, bags	Lb.	.03½—.04
Sodium Acetate	Lb.	.20—.22
Sodium Bicarbonate, 100% pure	100 Lbs.	4.00—4.50
Sodium Bichromate, bbls.	Lb.	.28—.30
Sodium Cyanide, bulk, 98-99 per cent., in cases	Lb.	.38—.40
Sodium Hyposulphite, kegs	100 Lbs.	3.60—4.00
Sodium Nitrate, refined	100 Lbs.	9.00—10.00
Sodium Silicate, according to density	100 Lbs.	4.00—6.00
Sulphur, ground	100 Lbs.	3.00—3.25
Sulphur, roll	100 Lbs.	4.75—5.00
Sulphuric Acid, 66° Be, carboys	100 Lbs.	3.25—3.50
Tannic Acid, commercial	Lb.	.90—1.10
Tartaric Acid, crystals or powdered	Lb.	95—1.00
Tin Chloride, crystals		(Nominal)
Zinc Sulphate, com.	Lb.	.6½—.07

Metals

Aluminum, No. 1, 98-99%	Lb.	.40—.45
" Government price in 50 ton lots for ingot 90-99% A 1	Per ton	$6.60
Antimony	Lb.	.14—.18
Brass, yellow ingots	Lb.	.20—.22
" red	Lb.	.24—.25
Cobalt, metal	Lb.	2.50—3.50
Chrome, 50% high grade	Per unit	$1.70
Cobalt oxide, grey	Lb.	1.65
Copper, casting	Lb.	.30
Copper, electrolytic	Lb.	.30
" Am. Government price (electrolytic and casting	Lb.	.26
Iron, bars	100 Lbs.	5.25
Lead	Lb.	.10—.10¼
Magnesium	Lb.	1.75—2.25
Mercury	Lb.	2.00—2.50
Nickel, shot or ingot	Lb.	.40—.45
Platinum, pure Goverment price	Oz.	105.00
Silver, bar (U. S. Govt. price)	Per troy oz.	1.01—
Spelter	Lb.	.10—.10½
Steel, mild	100 Lbs.	5.50
" nickel, in bars. 3½% Nickel	Lb.	.25—.27
" Sheet, Bessemer, 28 gauge	100 Lbs.	9.00—9.25
Tin	Lb.	.90—95

COBALT TEST CASE

Acquittal of the defentant was the decision given by Police Magistrate Armstrong, of Cobalt, in the case, M. P. MacDonald, mining engineer, charged with violating the Ontario Land Surveyors' Act by doing underground surveying. The case is regarded as one of importance to the profession, as establishing the right of mining engineers to do underground surveying, within properly recorded boundaries, as has hitherto been the general practice in Cobalt. An adverse decision might have entailed the re-survey of most of the underground workings of the camp. The exclusive right of the surveyors to make surveys for recording purposes is not disputed.—Engineering and Mining Journal.

CHEMICAL AND METAL MARKETS

Continued from page 274

be reduced by 25 per cent. This has sent up the price to $3 a pound.

In the drug market, menthol, camphor and saccharine have been the subjects of speculation. Saccharin had reached a point near $35 a pound, but supplies coming to sight in Great Britain broke the market down to $23 in a short time. It is expected that British manufacturers will soon be able to supply their domestic needs.

The National Paint, Oil and Varnish Association of the United States will meet in convention at Boston on the 21st to 24th inst., when important resolutions will be presented.

While ammonia alum is still quoted in the Canadian market at $6.00 to $6.50, in the U. S. centres it is now $8 to $8.75.

The export of cobalt oxide has been much restricted by the Canadian Government, and there is a strong demand for all that is available in the U.S.

Generally speaking, the demand for coal tar products exceeds the supply.

UNITED STATES POTASH STATISTICS

The statistics on the production of potash for the first six months of 1918 received by the United States Geological Survey, Department of the Interior, to date show a total output of 20,000 to 25,000 short tons of pure potash (K_2O), indicating that the output for the entire year may reach 50,000 to 60,000 tons. As only 32,573 tons were produced in 1917 the production is evidently increasing rapidly. The domestic production now equals 20 to 25 per cent. of the normal domestic consumption before the war, which is estimated to have been about 240,000 tons. The statistics for the first half of the year are not complete, for returns have not yet been received from a few large producers, and it is possible that the production in 1918 may exceed 60,000 tons, for reports indicate that a number of new enterprises may be put into operation during the second half of the year.—American Fertilizer.

"Industrial Progress," Vancouver, reports that a discovery of bauxite had been made at Lytton, B.C. This may lead to an aluminum industry in that Province. The possibilities of British Columbia along lines of electro-chemical development are certainly most promising. The establishing of a nitrogen fixation plant at Burrard Inlet is about to be undertaken immediately by the American Nitrogen Products Co. They will have available cheap power, abundant limestone, and coke. The limiting factor in locating both aluminum and nitrogen plants is cheap electric power, and in this regard British Columbia is blessed with untold possibilities. There is a time coming when the fertilizer industry in the West will demand all the nitrogen salts that British Columbia waterfalls can possibly produce.

Index to Advertisements

EMPLOYMENT DEPARTMENT

The charge for condensed advertisements of "Engagements Wanted," or "Positions Open," is 50 cents per month for advertisements of 40 words or less, no charge being made for the use of box numbers in care of CANADIAN CHEMICAL JOURNAL.

ENGAGEMENTS WANTED

Practical Metallurgist open for engagement, desires change, and would prefer position in any industrial laboratory, where ability, and ambition for promotion would be recognized. Box 21, CANADIAN CHEMICAL JOURNAL.

Chemist, familiar with gun-cotton, powder, TNT, nitric and sulphuric acids. Experienced in analysis of acids. Capable manager. Box 5, CANADIAN CHEMICAL JOURNAL.

A young engineering student desires a position in a chemical laboratory. Complete high school education as well as two years at Toronto University in the department of chemical engineering.—Box 16, CANADIAN CHEMICAL JOURNAL.

Chemist, with extensive experience in the textile trade, well up in coloring and the testing of dyes, wools, yarns, and all other produce used in a woollen or cotton mill. Box 24, CANADIAN CHEMICAL JOURNAL.

Practical Analytical Chemist open for engagement. Has had manufacturing experience in pharmaceuticals and drugs. Special experience in the analysis of glycerine and by-products in the manufacture of soap. Enquire Box 25, CANADIAN CHEMICAL JOURNAL.

POSITIONS OPEN

Assistant Chemist wanted for large chemically controlled industry in Maritime Provinces. Salary $1,600. A University graduate, well trained, energetic and resourceful is desired. Previous industrial experience not essential. Apply Box 22, CANADIAN CHEMICAL JOURNAL.

Process Foreman in TNT Explosives or Acid manufacture who desires to connect with a related industry which manufactures a commercial product can communicate with Box 17, CANADIAN CHEMICAL JOURNAL.

Large chemical works requires the services of several chemical Foremen who offer experience in some branch of process work. Must be accustomed to handling men. Good prospects in a permanent industry. State salary wanted and particulars on work you have engaged in. Box 18, CANADIAN CHEMICAL JOURNAL.

Chemist, not subject to Draft, wanted. Familiar with the recovery of crude glycerine from spent soap lye. Also capable of handling the analysis of fats and oils. Apply Box 23, CANADIAN CHEMICAL JOURNAL.

MACHINERY WANTED

The advertiser wishes to get in touch with makers of plant for the production of Hydroflouric Acid. Address Box No. 1, CANADIAN CHEMICAL JOURNAL.

CLASSIFIED INDEX OF ADVERTISEMENTS

Acetone and Acetates—
Standard Chemical Co.

Acids—
Dominion Tar and Chemical Co.
Lazard-Godchaux of Am., Inc.
Levinstein, Limited
Lymans, Limited
Mallinckrodt Chemical Works
Merck & Co.
McArthur, Irwin, Limited
National Drug & Chemical Co.
Nichols Chemical Co.
Standard Chemical Co.
The Topley Co.
U.S. Varnish Co.

Acid-Proof Paints —(See Paints)

Acid-Proof Apparatus—
Buffalo Foundry & Machine Co.
Maurice A. Knight
Luzerne Rubber Co.
Toronto Pottery Co.
U.S. Stoneware Co.
Valley Iron Works

Air Compressors—
Canadian Ingersoll Rand Co.

Alcohol, Wood—
Standard Chemical Co.

Alum—
A. M. Huestis
Nichols Chemical Co., Ltd.

Apparatus—(See Laboratory)

Architects—
Samuel M. Green Co.

Arsenic—
Coniagas Reduction Co.
Deloro Smelting & Refining Co.

Autoclaves—
Buffalo Foundry & Machine Co.
Detroit Heating & Lighting Co.
Lymans, Limited
Scientific Materials Co.
Ernest Scott & Co.
The Topley Co.
Valley Iron Works

Babbitt Metal—
Canadian Fairbanks-Morse Co.

Barrels—
Smart-Turner Machine Co.

Balances—(See Laboratory Apparatus)

Bismuth, Metal and Salts—
Merck & Co.

Bleaching Powder—
Canadian Salt Co.
The Mendleson Corporation
Nichols Chemical Co., Ltd.
T. E. O'Reilly
T. D. Wardlaw
Wilson Paterson Co.

Bunsen Burners—
Detroit Heating & Lighting Co.

Carbide—
Canada Carbide Co.

Carbolic Acid—
F. E. Cornell & Co.

Centrifugal Extractors—
Tolhurst Machine Works

Caustic Soda—
Canadian Salt Co.
Canadian Anilines & Chemicals, Ltd.
The Mendleson Corporation.
Merck & Co.
Nichols Chemical Co.
Wilson Paterson Co.
T. D. Wardlaw

Chemical Apparatus—(See Laboratory Apparatus and other headings)

Caustic Soda Plant—
Buffalo Foundry & Machine Co.
The Dorr Company
Samuel M. Green Co.

Charcoal—
Standard Chemical Co.

Chemical and Consulting Engineers—
Associated Geological Engineers
Buffalo Foundry & Machine Co.
J. T. Donald, & Co.
The Dorr Company
FitzGerald Laboratories
General Ceramics Co.
Gilbert Laboratories
Samuel M. Green Co.
James, Loudon and Hertzberg
Palo Company
Process Engineers, Limited
Ruggles-Coles Engineering Co.
George Taylor Hardware, Ltd.
Stillwell Laboratories
Ernest Scott & Co.
Toronto Testing Laboratory
Charles L. Weil
E. J. Young

Chlorine Plant—
Samuel M. Green Co.

Cobalt and Cobalt Oxides—
Coniagas Reduction Co.
Deloro Smelting & Refining
Keeling & Walker, Ltd.

Chemicals—
Benzo Chemical Co.
Chemical Products of Canada Ltd.
Chalmers, R. S. & Co.
F. E. Cornell & Co.
Canadian Anilines & Chemicals, Ltd.
Dominion Tar & Chemical Co.
Geigy Company Inc.
The J. F. Hartz Co, Limited
Hellenic Chemical & Color Co.
A. M. Huestis
Keeling & Walker, Limited
Kalbfleisch Corporation.
Lazard-Godchaux of Am., Inc.
Levinstein, Limited
Lymans, Limited
Mallinckrodt Chemical Works.
The Mendleson Corporation
McArthur, Irwin, Ltd.
Merck & Co.
Monsanto Chemical Works
National Drug & Chemical Co.
Nichols Chemical Co.
T. E. O'Reilly
Palo Company
W. A. Pye Co.
Standard Chemical Co.
T. D. Wardlaw
Wilson Paterson Co.

Colors—(See Dyestuffs)

Condensers—
Buffalo Foundry & Machine Co.
Detroit Heating & Lighting Co.

Copper Coils—
Detroit Heating & Lighting Co.

Compressors—(See Air Compressors)

Drills, Rock—
Canadian Ingersoll-Rand Co.

Drills, Twist—
Pratt & Whitney Co. of Canada

Disentegrators—
J. Harrison Carter, Ltd.

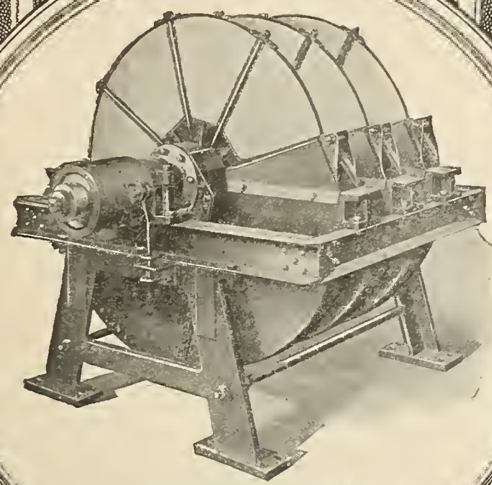
Drugs—
Benzo Chemical Co.
Chemical Products of Canada Ltd.
F. E. Cornell & Co.
Levinstein, Limited
Lymans, Limited
Mallinckrodt Chemical Works
Merck & Co.
Monsanto Chemical Works
National Drug & Chemical Co.
T. E. O'Reilly

Drums—(See Barrels)

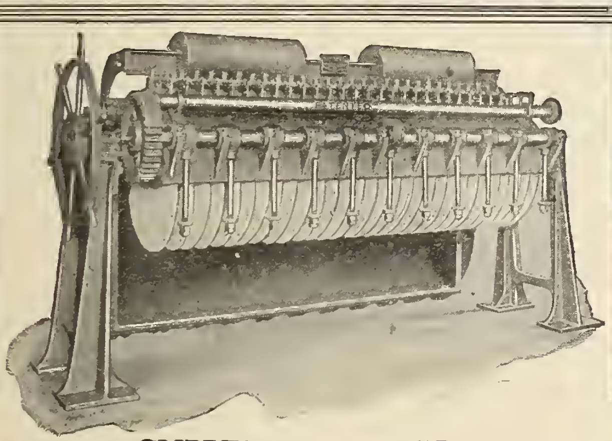
Dryers—
Buffalo Foundry & Machine Co.
J. Harrison Carter, Ltd.
General Ceramics Co.
Ruggles-Coles Engineering Co.
Ernest Scott & Co.

Dyestuffs—
Canadian Anilines & Chemicals Ltd.
Chalmers, R. S. & Co.

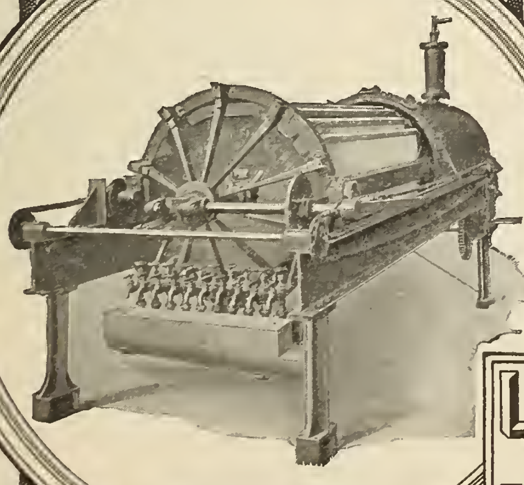
CLASSIFIED INDEX OF ADVERTISEMENTS—*Continued*



AMERICAN CONTINUOUS SUCTION FILTER



SWEETLAND FILTER



KELLY FILTER

Developed by Filtration Engineers—used by Men who *know* Filters

That we must install the most modern and labor saving equipment is unquestioned and is today of paramount importance. Increased production and shortage of labor demand it. Your filter station offers an unusual opportunity for saving labor and increasing production, providing the right equipment is used.

United Filters, just as the name implies, means a union of the best known types of filters. They are filters of the highest efficiency and require the least labor—in many cases requiring from one-fourth to one-tenth the usual number of men.

You can't go wrong with United Filters. Our laboratory is equipped for testing the materials to be filtered and will render a comprehensive report showing the proper type and size filter needed and what it will do for you.

Wide-awake superintendents are bringing their filtration problems to Filter Headquarters.

We have a handsome illustrated booklet which we will mail on request.

United Filters
CORPORATION

KELLY and SWEETLAND PRESSURE FILTERS AMERICAN CONTINUOUS SUCTION FILTERS
SWEETLAND'S PATENT METALLIC FILTER CLOTH

Sperry Bldg. Brooklyn, N.Y.	People's Gas Bldg. Chicago, Ill.	Felt Bldg. Salt Lake City, Utah	Nevada Bank Bldg. San Francisco, Cal.

MACHINE TOOLS

Equipment for
Locomotive and Car Shops
Structural Iron Shops
General Machine Shops

SHIP BUILDING MACHINERY

THE JOHN BERTRAM & SONS CO. LIMITED

DUNDAS, ONTARIO

Montreal Toronto Winnipeg Vancouver

SMALL TOOLS

Taps, Reamers, Dies, Twist Drills
Milling Cutters

Hobs and Special Tools

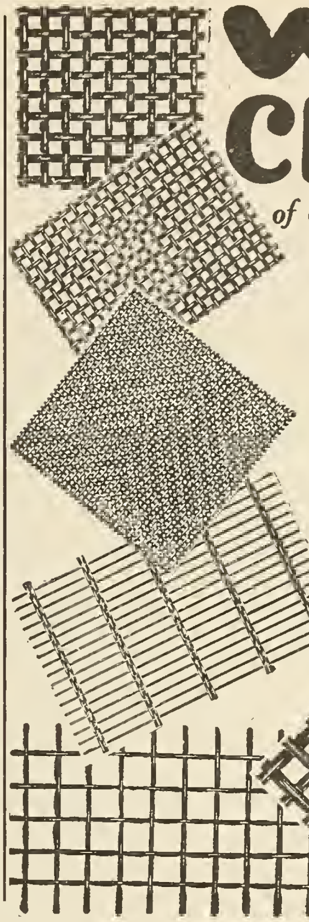
PRATT & WHITNEY CO. OF CANADA, Limited

Dundas, Ontario

Montreal Toronto Winnipeg Vancouver

Wire Cloth

of every description

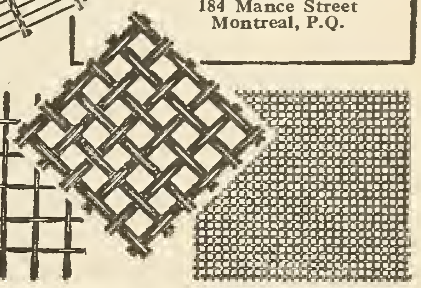


We make Ore Screening, Perforated Metals, Machinery Guards of all kinds.
Metal Lockers for clothes.
Steel Shelving for all purposes

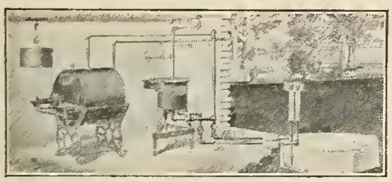
Enquiries Solicited

Canada Wire & Iron Goods Co.

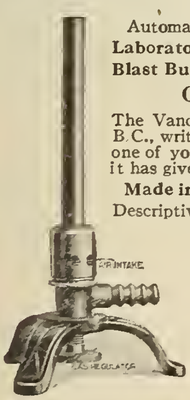
Hamilton, Ont.
East'n Representative:
H. E. Bull
184 Mance Street
Montreal, P.Q.



GAS FOR LABORATORY and INDUSTRIAL USE



The "Detroit" Combination Gas Machine



Automatically makes the best and cheapest gas for
Laboratory Uses Operating Blow Pipes
Blast Burners Cooking in Homes Lighting, Etc.

OVER 30,000 IN DAILY USE

The Vancouver Portland Cement Co., Ltd., Victoria, B.C., writes: "We have had in use in our Laboratory one of your 20-light Combination Gas Machines, and it has given every satisfaction."

Made in both Weight and Water Driven Types.

Descriptive catalogue and names of users in your locality sent upon request.

"DETROIT"
Laboratory Burner

LABORATORY
BUNSEN BURNERS

Ask for Catalogue of Bunsen Burners, we make the best for use on all kinds of gas.

DETROIT HEATING & LIGHTING CO.

614 Wight Street Established 1868 Detroit, Mich.

THE DORR SYSTEM OF

CONTINUOUS CAUSTICIZING

USING

Continuous Lime Slacking
Continuous Agitation
Continuous Counter Current Washing

THIS system is being installed by the United States Government at three of its new explosive plants. It will be used to produce 78 tons of caustic soda per 24 hours at one plant, 62 tons at a second, and 6½ tons at the third.

Specialists in Continuous Processes
Complete Plants Designed and Installed

THE DORR COMPANY

ENGINEERS

NEW YORK
Architects Bldg.,
101 Park Ave.

DENVER
1009 17th Street

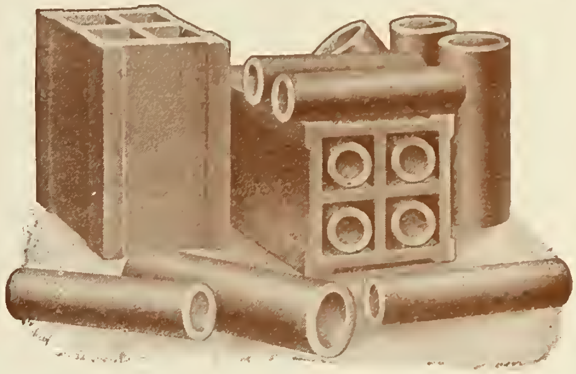
LONDON
16 South St.

Acid-Proof Tower Packing or Filling

We are now in a position to give

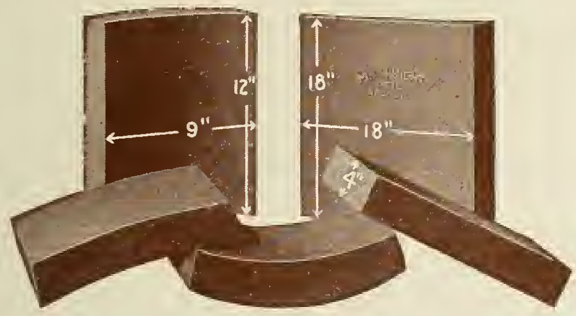
Prompt Deliveries

As we carry a large stock



TOWER PACKING "A," "B," "C"

A strong and efficient packing for large Sulphuric Towers.
"A"—Partition block, 8" x 8" x 12".
"B"—4" x 12" Pipe—to break joints.
"C"—3" x 12" Pipe to fill blocks, adding greatly to scrubbing surface.



ACID-PROOF RADIAL TILE

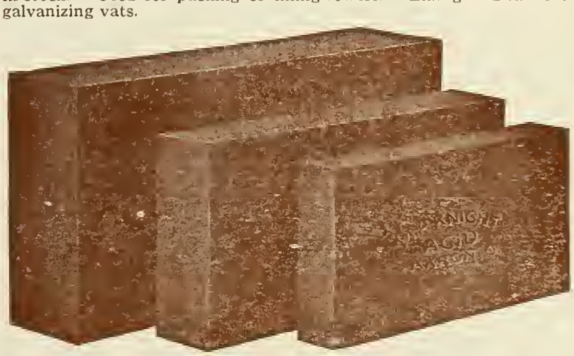
Made in any size or radius for building towers or tanks.

ACID-PROOF VITRIFIED BRICK

Made in most any size or shape. Standard size 8" x 4" x 2" carried in stock. Used for packing or lining towers. Lining acid tanks or galvanizing vats.

ACID-PROOF PARTITION RINGS

The most popular tower packing for any kind or size tower. Note the curved partition. These rings afford a good draft and a maximum scrubbing surface. Made in three standard sizes—4" x 3", 6" x 4", 6" x 6"—carried in stock.



LARGE ACID-PROOF TOWER BASE-TILE

Used for bridge work at bottom of towers for supporting packing. Made in any sizes up to 60" x 36" x 6".

We do not depend upon a glaze, enamel or veneer
Let us send you prices and circulars

It is the
BODY ITSELF

We make every description of Acid - Proof Chemical Stoneware, from special pieces to complete plants.

MAURICE A. KNIGHT

Office and Factory
Kelley Avenue

East Akron, Ohio

CANADIAN CHEMICAL JOURNAL

A Canadian Journal devoted to Metallurgy
Electro-Chemistry and Industrial Chemistry.

Vol. II, No. 11 TORONTO, NOVEMBER, 1918 20c. a copy; $2 a year

PROFESSIONAL DIRECTORY

CANADIAN CHEMICAL JOURNAL

A Canadian Journal devoted to Metallurgy
Electro-Chemistry and Industrial Chemistry.

Vol. 2 TORONTO, NOVEEMBER, 1918 No. 11

Canadian Chemical Journal

Devoted to the Chemical and Metallurgical Interests of Canada

Published monthly by the Biggar Press Limited
540-541 Confederation Life Bldg. - Toronto, Canada

E. B. BIGGAR, Managing Director **L. E. WESTMAN, M.A.**, Editor

Telephone Main 7399

Subscription price, $2, per year to Canada, United States and all parts of the British Empire; Foreign countries, $2.50 per year.

Time of going to press, 1st of each month. News and changes of advertisements should be in hand one week before.

CONTENTS

Back numbers of the Canadian Chemical Journal are wanted, dating from July to December, 1917 inclusive. Full prices will be paid for copies received with reading matter pages in good condition. Wanted also Nos. 1 to 4 of Vol. 2.

BUY VICTORY BONDS

THE realization of "Victory" was never so close before. The race that began as a sprint for Germany has long since turned into a Marathon. The pace has begun to tell, and the extended distance is leaving the weaker ones either out of the race or staggering. Germany herself is practically on her knees; fighting hard, but with fading hopes. Now is the time to tighten up for a sprint on our part. It may be the last, and it may not; that should make no difference. We have heard much of the "Will to conquer" on the part of our enemies. Let us show them a "Will to conquer" now by properly supporting the national effort and driving the Victory Loan through to success. Whether we have peace to-day or next year, the obligations of the country are such as to necessitate this loan.

The chemical industries of Canada have prospered and have grown enormously. Anything that was started has met with success. It is their opportunity now to consider that all this prosperity was built up, sustained and made possible, by a line of fighting men thrown across France and Belgium. These industries have had the easier task and we know the men behind them will respond—not grudgingly, but enthusiastically, and to their utmost ability. Be British and shoulder your share.

A DOMINION PUBLIC HEALTH LABORATORY

IT has always taken considerable scare and much outside pressure to move the Cabinet on such a measure as the establishing of a Public Health Laboratory. The national epidemic of Spanish influenza has provided the necessary stimulus for promised action at the very least. Already there are health branches in some departments at Ottawa. Immigration and Agriculture already do something along these lines. The laboratories of the Department of Trade and Commerce are health laboratories in a certain sense. If the Government takes any action, it might well institute a new measure of co-operation with provincial and local health and food officials.

The mere establishing of a new laboratory in Ottawa with high ambitions for safeguarding the general public health will have but little significance unless its work is properly backed up continually by some member of the Cabinet.

So far special or organized interests alone seem to have shown aptitude for reaching the sound ear of the above body.

UNIVERSITY STUDENTS AND CHEMICAL WAR WORK

IN an article in this issue we give the general plans of our United States Allies in reference to the problem of using the universities for chemical war work. Although many of the men they propose to train may never be used in chemical work directly connected with the war, as recent events on the Western front would indicate, the whole scheme is one that is sure to bring most substantial rewards to the industries of peace. There would seem to be a lesson in this movement for Canadian Universities. We have offered certain inducements to graduates in chemistry through the establishing of Research scholarships by the Honorary Advisory research Council. As far as the war period is concerned, they really amount to practically nothing. A very few of the younger men have been stimulated to remain in research work by this means as yet. A survey of our universities if taken during this term would show that no very special campaign was under way, intended to direct students into courses in chemistry. At best, our universities combined turn out only a mere handful of graduates specially trained in chemistry, and many of these enter the teaching profession. If it is desirable that a greater number of students should enter upon courses in chemistry at our universities it would seem that the efforts made to obtain them must be exceedingly weak. We find unprecedented rushes by hundreds into freshmen courses in medicine. These movements have the dual backing of the military authorities and popular conception of a necessity. Since there has been no special recognition either of graduates or undergraduates in chemistry, we find such students leaving our Canadian Universities to join various units of the army, while we find American students in chemistry being paid and directed to remain at their work.

Now, it is a wonderful spirit that reigns in our universities, and all honor to the boys who do not wish to hide behind fighting units in technical positions. At the same time a measure of sanity should prevail. We have the opportunity of developing large chemical industries in this country and there is no valid reason why these should not be directed by Canadian chemists trained in Canada.

ELECTRO-CHEMICAL POSSIBILITIES IN CANADA AFTER THE WAR

THE recent meeting of the American Electrochemical Society in Atlantic City brought again to the attention of the public the great possibilities for the further development of electro-chemical industries in Canada. The situation as it is likely to shape up after the war was fully discussed. We have the general problem of public or private ownership of water powers to settle in a suitable manner. Mr. A. H. Hooker and Dr. V. R. Kokatnur, of Niagara Falls, covered the present and probable future of the chlorine and alkali industries. Dr. W. S. Landis, of the American Cyanamid Co. pointed out the probable outlet of excess nitrogen products after the war. It is expected that the fertilizer industry will absorb all that may be produced. The necessity for fertilizers in the Middle West fields of Canada and the United States opens up a market capable of handling any over-production that there may be for practically all time. Mr. F. D. J. FitzGerald, of Niagara Falls, gave a vrey interesting discussion on the electric furnace after the war. His paper, in detail, is given in this issue. Dr. J. A. Mathews treated the subject of electric steel. In the electric furnace better solution and diffusion are obtained. In the last year the production of electric pig iron in Canada has increased from 900 to 2,500 tons per month and it is expected to be over 4,000 by the end of November. Mr. R. Turnbull, of Welland, gave a very instructive paper on this subject showing that the good quality of this product was very likely to insure its future use by high grade steel manufacturers. Mr. Henry E. Randall pointed out that the use of peak power was rapidly increasing in Canada. In Ontario the consumption of electric power is 2.5 times greater per capita than in any other like community. When everything is considered the future for electro-chemical industries in Canada is as bright as any people could desire. It only requires a measure of judgment on the part of government officials and some co-operation among the industries themselves, to make certain of the largest measure of success.

A NEGLECTED ATTITUDE TOWARDS INDUSTRIAL RESEARCH

THERE is a side to the general problem of initiating a larger measure of research work in the industries of Canada that is at times sadly overlooked. It is just possible that we are hastening over a step that we should stop and consider more carefully. More attention seems to be directed to the undertaking of absolutely new problems in a certain way than is given to the application to Canadian industries of relatively new ideas, machinery or processes already found to work well in a small way either here or abroad. If it be true that we have a single plant

or industry in Canada that is handicapped in its work through the fact that it is competing with other firms using more efficient methods, it becomes the first duty of the Research Advisory Council to disseminate corrective information, and sound assisting advice as quickly and as often as may be necessary until Canadian firms are no longer under any handicap that can possibly be removed as far as efficiency in production in concerned. It is equally the duty of all companies to assist in the diagnosis of their own cases.

Previous experience in industrial development has shown that good ideas and real inventions have had to struggle sometimes against tremendous odds before establishing themselves. Their application has been local, and it has taken years before any worldwide utilization of the new truth was possible. If we had a body of men whose special duty it was to discover and observe these movements in embryo and to hasten their more general application, we would be considering the problem of the advancement of industrial research in Canada from a very sane viewpoint. It would seem that we are more at home establishing groups of men whose business it is to reach into the absolutely unknown, than we are at getting together men who will develop what we have already forgotten exists in our mass of scientific and chemical literature, or pause to consider the proposals of others. We need a little more digestion and discipline in handling the practical applications of our research work.

Within certain limits many industries could be established in Canada provided Canadians were given the opportunity and inducement to go abroad to work and observe until such time as they had gained sufficient knowledge to duplicat the best foreign practice here at home. Part of the recent trouble with the dye industry was that we had overlooked this very point. It was much easier to buy than to make. Whether it is duplicated, by actual travel and observation or by experimentation carried out at home, this should constitute a larger portion of the general aim of our industrial research leaders than it does. The Government alone, through the medium of a new type of industrial civil servant, can hope to go far with this idea. Presuming that guilds are established among those industries that naturally lend themselves to amalgamation in matters of research, would it not be well for them so aim first at catching up in all possible ways with the best practice in the world, and secondly to advance beyond anything at present known? More immediate returns might be expected from house-cleaning and rearranging present methods of working, if this were done with a broader vision, than from attempting to outstrip all that has been done, right at the start.

The accumulated power of any cycle of industries when once established in any country, is enormous. Class persecutions and wars were the world's only means of disseminating knowledge for centuries, and we have not entirely passed through this stage yet. The development to a broader application of any idea can never be considered a theft. Canada's research field may well be centred in the main on this basis. Absolutely new developments can only be counted on to beautify this structure with originality

Technical industries were brought to England long ago by the migration of workmen, and not by the establishing of a research laboratory to discover how to do such things. Applied research becomes an art, and much of the research work carried on since 1914 has been due to the necessity of immediately mastering the art under extreme difficulties. It is unfortunate, perhaps, that it was necessary to establish our industrial research propaganda during a time of abnormal war trade restrictions. Although established then, it should really be based on peace conditions under which it must eventually work.

How to obtain that pooling of the best ideas from each plant, and thereby to establish a uniformly high efficiency in the whole industry without introducing us to a truly socialistic regime, would seem to constitute part of the work in hand. The "Liberty" engine was an example of such work carried out under the high tension of war-time fervor. The "Liberty" engines of peace will be much more elusive. At the same time, our grouped industries must pass along this road before they come to the point where united research work, as it is ordinarily understood, may properly begin. Although the conception is relatively new and the future vague, our Canadian industries should not shirk from undertaking the most modern methods of co-operation.

A CALL FOR CO-OPERATION AMONG CHEMICAL INDUSTRIES

Some time ago the Society of Chemical Industry issued a circular to a large number of firms in Canada whose business either in whole or in part depended directly on the application of chemical principles to industrial work.

Now although this was done in the name of the Society of Chemical Industry and the Honorary Advisory Council for Scientific Research in the direct interests of the firms concerned, only a small percentags of those circularized saw fit to take the time to reply.

The Canadian Chemical Journal would again bring the matter to the attention of its readers. It is the duty of every firm in any of the industries mentioned to properly inform the Government in order that they may receive in return the active assistance of those organizations that are in a position to and willing to give substantial aid to the chemical industries of Canada.

We quote Mr. Burton's letter directly as issued along with the Memorandum, in the hope that more firms may find a few minutes to make a suitable reply.

To the Chemical and Allied Industries of Canada,—

Gentlemen:

In 1908 this Society issued a monograph, which was the first effort made to record the chemical industries of Canada.

Owing to the necessities arinisg out of the war there has been a

great growth of the industry in Canada until to-day it holds an important place in the economy of the country, which it is very desirable should be maintained after the war.

Having this in view, I am directed to inform you that this Society, in conjunction with the Chemical Committee of the Honorary Advisory Council for Scientific and Industrial Research has deemed it opportune to issue this information, revised to date, and herewith for this purpose you will find enclosed a memorandum which it is requested that you should fill out and return to the above address at the earliest possible date.

It is the desire of the Society to place in the hands of all contributing towards the success of this work, a copy of the same, with the hope that it will bring the chemical industries of the country more closely into touch with each other, to their mutual advantage and support, and also to avoid enemy domination over our chemical industries.

Appreciating your hearty co-operation in the matter,

I am, yours truly,

(Signed) Alfred Burton,
Hon. Secretary.

Kindly fill out this form carefully and return to Society of Chemical Industry, Alfred Burton, Hon. Sec., Explosives Dept., Imperial Munitions Board, Ottawa.

Memorandum re Chemical Industries

Method of Classification:—

I.—General Plant, Machinery.
II.—Fuel, Gas, Heating, Lighting
III.—Tar and Tar Products.
IV.—Colouring Matters and Dyes.
V.—Fibres, Textiles, Cellulose, Paper.
VI.—Bleaching, Dyeing, Printing, Finishing.
VII.—Acids, Alkalies, Salts, Non-Metallic Elements.
VIII.—Glass, Ceramics.
IX.—Building Materials.
X.—Metals, Metallurgy, including Electro-Metallurgy.
XI.—Electro-Chemistry.
XII.—Soaps, Fats, Oils, Perfumes.
XIII.—Paints, Pigments, Varnishes, Resins
XIV.—India Rubber, Gutta Percha.
XV.—Bone, Horn, Glue.
XVI.—Soils, Fertilizers
XVII.—Sugar, Starches, Gums.
XVIII.—Fermentation Industries.
XIX.—(a) Foods.
(b) Water Purification Sanitation.
XX.—Pharmaceutical and Medicinal Substances
XXI.—Photographic Materials and Processes.
XXII.—Explosives, Matches.
XXIII.—Wood Distillation Products.
XXIV.—Leather and Tanning.
XXV.—Miscellaneous.

Firm . . . .
Class . . . .
Specialty or Specialties . . . .
Raw Materials . . . .
Quantities Consumed . . . .
Source of Supply . . . .
Domestic and Foreign . . . .
By-Products . . . .
Quantity Produced . . . .
Output of . . . .
Main Product . . . .
Any other information . . . .

Special War Bulletin, No. VII. of the American and Canadian Section of the International Association of Medical Museums, contains a report by Dr. Alice Hamilton (Hull House, Chicago) with reference to industrial poisoning in munition works and aircraft factories.

GRAPHITE DEVELOPMENTS

In the October number of this Journal there appeared an article on Developments in Ceramics, by A. V. Bleininger, in which reference was made to the superiority of Ceylon graphite. It was pointed out that its greater density, its foliated structure and the low ash content of the best grades make it very satisfactory for the purpose of crucible making.

In this connection it is particularly interesting to note that a new flotation process for the concentration of graphite developed by Mr. Charles Spearman is giving very marked results. By this process a product is produced which has a density much nearer that of Ceylon graphite than any other domestic (Canadian or American) product on the market. Practically a complete recovery is obtainable of graphite which contains over 90 per cent. carbon and which is free from mica. The chief difficulty in concentrating Canadian deposits up to the present time has been the removal of the impurities which consist largely of mica and in some cases Wollastonite. This difficulty has been overcome by this new process. Dry screening methods have been used in a number of places, but these combined with the use of the Huff Electrostatic have not been successful. Deposits which have been unsuccessfully worked heretofore, and other large deposits which have been lying idle will now be worked by the Spearman process.

The Globe Graphite Mining and Refining Co. has at Port Elmsley a large deposit of flake which is unexcelled for crucible work. Although this deposit has been worked periodically for the past fifteen years, poor extraction and the high mica content of the product made operations unsuccessful. Since August the Spearman process has been in operation and 20 tons of crucible flake graphite have been shipped. A complete new 50 ton unit is being installed and will be ready for use this month.

The plant of the National Graphite, Ltd., of Harcourt, Ont., has been closed since about 1912, but at the present time a 50-ton unit of the Spearman type is being installed and will begin operation this month.

The St. Remi D'Amherst Graphite, Ltd. are installing a 50:ton unit to begin operating under the Spearman process about December 1st. A 200-ton mill is being installed on the Timmins property near Westport and will be in operation about January 1st.

Charles Spearman, B.Sc. (Queens '10), M.A. (Columbia, '12), the inventor of this much needed process, is a mining engineer and geologist whose address is 4311 Montrose Ave., Westmount, Que. Mr. Spearman has had a varied experience in mining and geology. During 1912 he taught in the Haileybury Mining School. In 1913-14 he was in charge of a gold property in the Kirkland Lake District. In 1914-16 he carried on a consulting practice in Haileybury. In 1916-18 as well as continuing his consulting work, he was engaged with the Renfrew Molybdenum Mines, Ltd., at Mount St. Patrick. During his university course, and up to the present time, Mr. Spearman has devoted considerable time to the concentration of ores and the excellent results obtained in treating graphite and molybdenite ores with his recently perfected process are his reward. His process and various features of the apparatus used are being protected by Canadian and foreign patents, but these are being withheld from issue and publication for the duration of the war by the Patent Offices.

PAPER LIFEBOATS

A rather tough fibre paper, made from the mulberry tree has been used for making collapsible lifeboats for the Japanese Navy. The paper itself is not new, but the special process for making it waterproof claims to have some novel features. Large research staffs have been set to work quite recently by Japanese manufacturers on the general problems involved in finding new uses for fibre and paper. Here is a fine opportunity for a new line of research work which would result in an important extension of a Canadian industry already of great magnitude.

Nitrogen Fixation Furnaces*

By E. Kilburn Scott (Electro-Chemical Engineer)

Arc furnaces for fixing atmospheric nitrogen differ from arc furnaces for making alloys, carbide, etc., in that instead of the electrodes being of carbon they are made of special metal, which wears away very slowly. Also, the potential used is several thousand volts, which necessitates better insulation. Another difference is, that air only is used or charged; the internal construction is therefore simpler, as regards the refractory lining, for there is no melted metal or flux to re-act with or to cut the brickwork.

The furnaces are especially suited for intermittent working with off-peak power, because they can be started and stopped at any moment with almost the same facility as an ordinary arc lamp, and there is no fused material to be run off or to freeze in case the electricity fails; also, after starting up again, full yields are obtained very quickly. The furnaces may therefore be advantageously installed wherever cheap three-phase power is available for say 16 or 20 hours a day, and this is the only type of furnace for fixing atmospheric nitrogen that can be so used.

A convenient size of air nitrate factory is one to take about 10,000 kw., but of course the larger the factory the lower the cost per kilowatt of plant installed, and the lower the working cost and of overhead charges per unit of finished product.

The ordinary standard voltages of 5500 and 6600, and periodicities of 25 and 60 per second, are suitable, so it is not necessary to install special generating machinery. The energy can be tapped from a general transmission network, although there are advantages in having the factory near to the power house.

To combine nitrogen and oxygen efficiently by electricity, it is necessary to obtain as intimate contact as possible between the gases and the arcs, and various features which more closely approximate to this requirement are discussed in this paper; further, in order to emphasize certain points, comparisons are made of types of furnaces, especially those which produce the arcs in different ways. For the purpose of discussing types of furnaces, they can be classified as follows:

(A) Designs having mechanically movable parts.
(B) Designs employing a magnetic field to direct the arcs.
(C) Designs depending on air currents only to direct the arc.

(A) Designs Having Mechanically Moving Parts

The Bradley and Lovejoy apparatus as it was installed at Niagara Falls is historical but nevertheless interesting, because it is a distinctive type. It depended on the formation, prolongation, and interruption of many thousands of sparks or arcs per second, each one separate from the rest. The arcs were produced by rotating an iron cylinder fitted with platinum points inside a fixed enclosing cylinder having an equal number of points. Direct current at 10,000 volts was employed, partly because the apparatus was built at a time when that form of current was generally in use. It was afterwards appreciated that it would have been better to work with alternating current.

MacDougall and Howles, who were working on the problem in England about the same time, employed alternating current, and the writer gave them assistance, especially in showing how the arcs could be stabilized by reactance.

Another design depending on mechanical movement is that of J. Simpson Island of Toronto.

As will be seen from Fig. 1, there are in this furnace four V-shaped rings, two of which rotate, and the electric arc which would normally remain stationary at the shortest gap is drawn around. To the eye it looks like a ring of flame, but in reality it is a single arc rotating rapidly around the annulus. Air passes through perforations in the apices of the stationary rings, and at first sight this would appear to be a good plan. The writer's experience, however, is that such holes are subject to excessive burning.

The Rankin furnace, to which T. H. Norton draws attention in an article in Scientific American, Sept., 1917, has been tried in California. It is a distinctive type because the arcs are mechanically caused to move through the air, instead of the air being blown through the arcs. The sparking points are fitted in a sort of piston which reciprocates in a cylinder and at the same time is rotated to and fro by a thread on the spindle. Current is led to the sparking points by wires through the hollow spindle.

As general comment on the above, the writer considers that designs depending on a number of electric sparks or arcs which are at relatively large intervals apart, must necessarily allow considerable quantities of air to pass without contact. Further, designs which require constant mechanical movement of parts are obviously at a disadvantage when compared with those referred to below, which do not require moving parts.

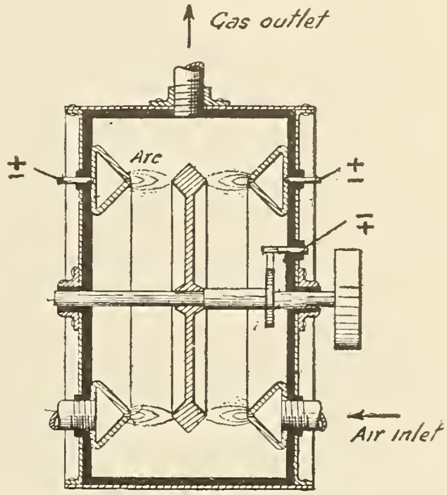


Fig. 1. The Island furnace, with mechanically rotated arc.

(B) Designs Employing a Magnetic Field.

The Moscicki furnace, used in Switzerland, has a magnetic field which causes the arc to rotate round an annular opening. Referring to Fig. 2, there is a reaction chamber with an air chamber below, both of which are surrounded by water. The annular opening is formed between a high tension electrode and the lower edge of the reaction chamber, which latter is earthed, Magnet coil D, acting in conjunction with the steel construction of the furnace, sets up a magnetic field across the annular opening which causes the arc to rotate. It can, however, only be at one point at any one moment, whereas air passes through the whole opening all the time; it therefore follows that a large proportion cannot contact with the revolving arc.

The Birkeland-Eyde furnace used in Norway, France, and Spain, has also a magnetic field, but in this case it forces the arc into two half discs of flame, which alternately rise and break in the top half and in the bottom half of the reaction chamber. The electrodes, see Fig. 3, are of copper tubes supported on ball insulators, and they project into a circular reaction chamber, the side walls of which are pierced by a large number of small holes. Air passing through these holes strikes into the flame at right angles, and obviously at any moment only half the volume can enter on the side on which is the arc.

The arc constantly rises and breaks, and, further, many of the holes are near to the edge of the reaction chamber. A large p-or

*Paper delivered before the 34th meeting of American Electro-Chemical Society, Atlantic City, U.S.A.

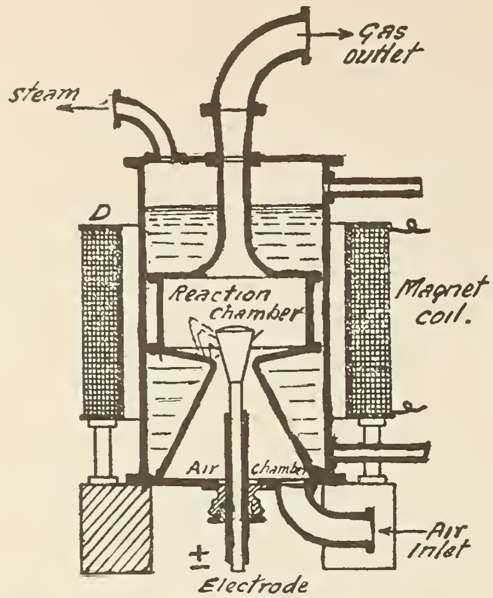


FIG. 2. Moscicki single-phase furnace having magnet coil to give rotation of arc.

portion of the air, therefore, fails to make contact with the arcs.

As further general comment on those furnaces which depend on a magnetic field to direct the arc, the writer is of opinion that they are at a disadvantage compared with those mentioned below, which use air only, because of the expensive magnet steel construction which interferes with accessibility, the cost of copper magnet coils, and the cost of dynamo electric machinery necessary to provide direct current to excite the coils. Another reason is that an extra circuit is required, with instruments and regulating switches, etc., in order to adjust the strength of the magnetic field to suit the velocity of the air.

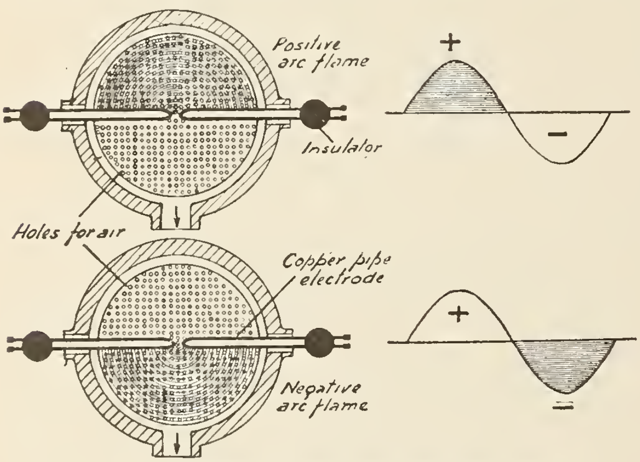


FIG. 3. Alternating arc flame of Birkeland-Eyde furnace.

(C) Designs Depending on Air Currents.

In the Schoenherr furnace, as used in Norway, air is blown tangentially into the bottom of a vertical reaction tube made of steel, and in passing upward with a whirling motion it maintains a rod-like arc in the center. To distinguish this arc from those of other furnaces, the writer calls it a "standing arc." The cross section of the reaction tube, see Fig. 4, is about 30 sq. inches (190 sq. cm.), whereas the section of the arc is only a small fraction of an inch; therefore much of the air whirls past without coming into intimate contact with the standing arc.

A point of interest is that this design is the only one which has an air preheater combined with it. This takes the form of annular tubes, as shown in section in Fig, 4, through which the hot gases and the air pass in contra-flow directions.

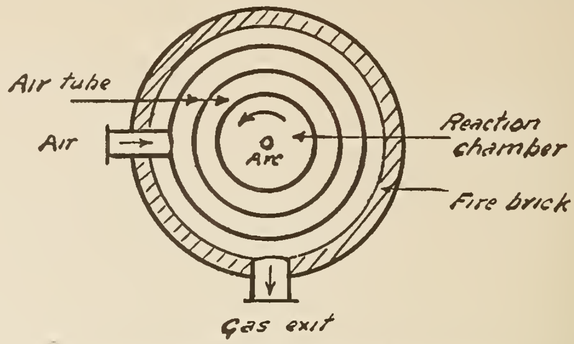


FIG. 4. Cross section of reaction chamber and annular preheater tubes of Schoenherr furnace.

The Wielgolski furnace, used by the American Nitrogen Products Co. of Seattle, Wash., has also a standing arc, but instead of being similar to a single straight rod it is in the form of a "bight" having its ends springing from electrodes at the bottom. For a given voltage, the height of the arc is therefore considerably less than in a Schoenherr furnace. The electrodes are hollow and air is blown straight through them without any whirling motion.

The Pauling furnace, used in Italy, Austria and Germany, has a fan-shaped arc flame which forms between horn-shaped castings. Below the electrodes there is an air pipe having a narrow slot, the idea being to get as much air as possible into the flame, but as a matter of fact, it spreads out in all directions as indicated in Fig. 5. Fig. 6 shows a modification installed at Nitrolee, S.C., and due to R. Phaehler and I. Heckenbleckner. Each electrode is supported at the bottom only, and the cooling water enters and leaves at that point, experience having shown that an upper connection causes short circuits and is difficult to insulate. Air is blown through two nozzles, the inner one passing a relatively small quantity at high pressure so as to cool the kindling blades. The bulk of the air which is preheated passes through the outer nozzle at low pressure. The power is therefore less than would be the case if all the air were at high pressure. Each side wall between the electrodes and just above the zone of maximum heating has a duct through which gases from the furnace, which have been cooled down, are blown. The object is to cool the highly-heated nitric oxide below the critical temperature of dissociation, and as the return gases contain practically the same percentage of nitric oxide gas as the freshly treated gas, there is no dilution.

Furnaces which work with single-phase alternating current have to be used in sets of three on a 3-phase supply, whereas the Kilburn Scott type now to be described in greater detail uses all 3 phases in a single reaction chamber.

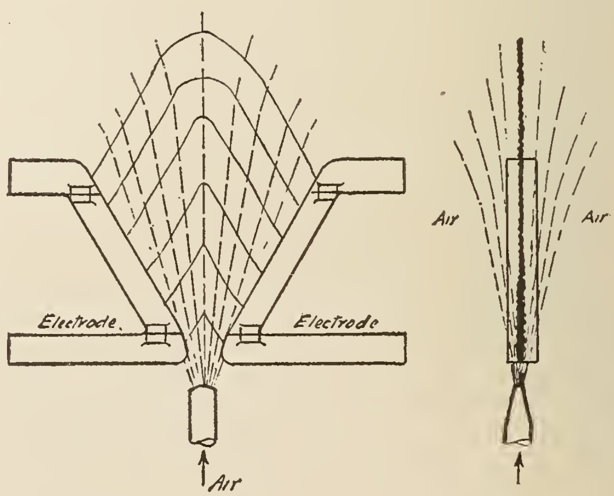


FIG. 5. Arc flow in relation to the arc of a Pauling furnace.

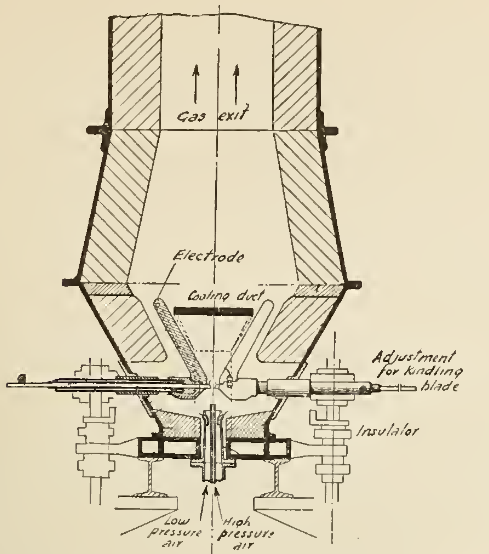


FIG. 6. Modification of Pauling design due to Pfaehler and Heckenbleckner.

The Kilburn Scott Furnace

As shown diagramatically in Fig. 7, it has three wedge-shaped electrodes arranged with intervening refractory material so as to enclose a six-sided conical space, having its apex at the bottom. Three-phase current supplied to the electrodes produces a combined arc which is flared out by the air, and with 60 periods gives 360 flames per second.

By drawing three sine curves with a phase displacement of 120 degrees, as in Fig. 8, it is seen that current is always flowing in the reaction chamber, and it can be shown mathematically that the power factor varies between 0.86 and 1.0. On the other hand, with the single phase the power factor varies from zero to maximum, and twice in each cycle there is no current.

The flame appears to the eye like a double cone having one apex at the bottom, where the electrodes are nearest together, and the other at the top, where the flame tapers off. The flames flicker

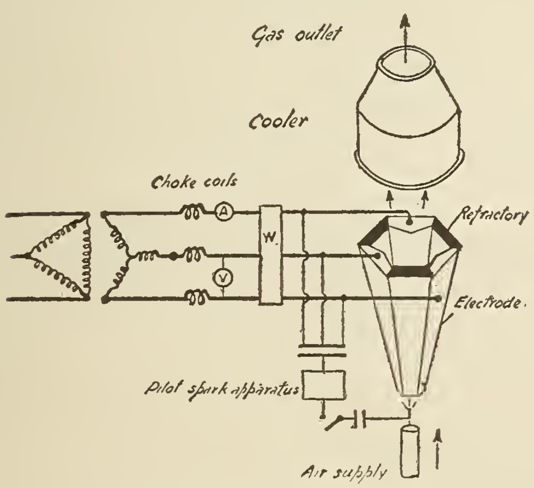


FIG. 7. Diagram of Kilburn Scott 3-phase furnace.

about with great rapidity in different planes, and so are constantly intercepting fresh particles of air. Fig. 9indicates how it revolves, the speed of revolution corresponding to the frequency. If we assume 60 periods per second, then as it takes longer than 1/60 second for air to pass up the reaction chamber, it follows that practically every particle must come into the arc.

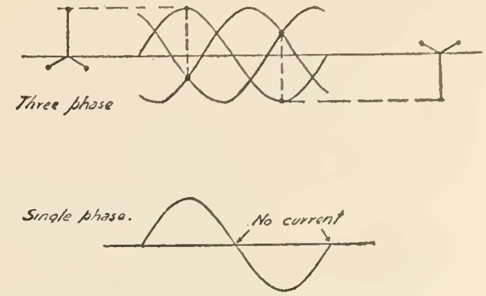


FIG. 8. Comparative curves of 3-phase and single phase.

Balance of Phases

From the point of view of the supply of electric energy, it is desirable to have all three phases balanced, and this is especially necessary when current is purchased from a public supply company, for the general supply must not be affected by low power factor and unbalanced and variable loads.

When single-phase furnaces are connected to a three-phase supply, there may be considerable lack of balance due to one furnace dropping out of circuit; also at starting up, unless all the furnaces are switched in together. If one arc fails, there is a possibility that the circuit breakers of the other furnaces may trip, with the result that a heavy load is suddenly thrown off, and a surge may set up.

The three-phase furnace gives no trouble in this way, for it functions as a single unit and the phases balance automatically. Even if deliberately set so that they do not balance, they tend to equalize by burning at those points where current is greatest. There is very little chance of a three-phase furnace failing altogether, because the three phases help to maintain one another.

Starting Up the Furnace

As the electrodes of nitrogen fixation furnaces are of metal and work at high voltage, they must not be brought into contact. Starting is usually effected by carefully moving the electrodes until they are near enough for current to jump across. After running until the interior has become heated, the electrodes are withdrawn to the regular working distance. Adjustment must be made carefully to minimize rush of current, and as this depends on the furnace attendant, the amount of reactance in circuit has to be sufficient to allow for the contingency of careless operation.

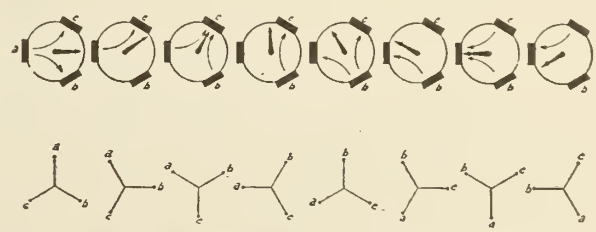


FIG. 9. Diagram showing rotation of 3-phase arc.

The Schoenherr furnace is started by means of a lever which is moved by hand, until it is near enough to the lower electrode for the current to jump across. The lever is then withdrawn and the whirling air carries the arc to the top of the reaction tube. In case the arc fails, which is fairly frequent, it has to be re-kindled by hand, so considerable attention is necessary.

Pauling uses the device shown in Fig. 10, which shows two furnaces connected in series in each leg of the three-phase supply, and an auxiliary transformer connected across one pair of electrodes on each series. The high tension coil of this transformer gives a voltage several times greater than the main supply, so that if an arc fails the current which is shunted through the primary immediately induces a higher voltage to again start the arc.

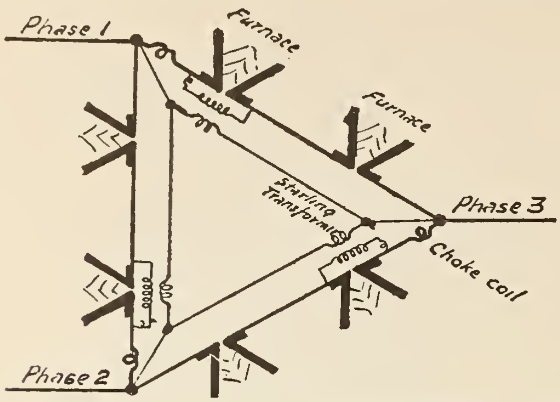


FIG. 10. Pauling furnaces in series on each phase and startidg rcformers.

While experimenting with an early model of the Kilburn Scott (K. S.) three-phase furnace, it was found possible to use pilot or trigger sparks to break down the air dielectric and thus dispense with movement of the electrodes for starting. This is a simple solution of the problem, and does away with uncertainty of operation by an attendant. A wire, placed midway between the three electrodes just above the central air nozzle is connected to an extra high tension supply, which causes sparks to jump from the wire to the electrodes, thus ionizing the air and causing the main current to flow. The more pilot sparks there are in a given time the better the effect; also, the higher the frequency the less the air resistance. The two circuits work together in much the same way as that which enables telephone and telegraph messages to be carried at the same moment through one set of conductors.

With pilot sparks to break down the air dielectric, using 3 phases in one furnace, the full value of the current wave is utilized and the curve approximates to a sine wave. On the other hand, with single phase the voltage has to rise to a certain amount to overcome resistance and cause current to flow.

Size of Furnace

A 3-phase furnace is better than three single-phase furnaces aggregating the same power, because there is only one piece of apparatus to attend to and the cost is at least halved; the space occupied, inclusive of passage way round the furnaces, is also much less.

As a 3-phase arc flame increases in three dimensions with increase of power, it follows that the capacity varies as the cube, therefore doubling the linear dimensions will theoretically increase the capacity eight times, and a 3-phase furnace may be of large capacity and yet not unwieldy.

Speaking generally, the larger a furnace the more accessible are the interior parts and the easier it is to adjust and renew the electrodes. Radiation lossses are also relatively smaller, and the percentage of energy absorbed by the reactance coils being less, the power factor tends to be higher.

The Schoenherr design is limited to about 1,000 K.W., because the length of the reaction tube is governed by the voltage, and at the same time the current that can be dealt with from a single electrode is limited. Again, the amount of air that can be passed through a reaction tube at a given velocity is limited, so in order to increase output a larger diameter tube would have to be used, thus giving greater clearance around the arc.

Birkeland-Eyde furnaces are now built with a capacity of 4,000 K.W., which is about 20 times larger than those made some twelve years ago. They are essentially a single-phase design. During the same period, carbon-arc furnaces for making alloys, and for carbide have increased in a much greater ratio, and they are all now made for multi-phase working.

Radiation and Cooling-Water Losses

In the Schoenherr furnace, radiation accounts for 17 per cent., and the electrode cooling-water about 30 per cent. It is therefore desirable to design electric furnaces with as small radiation surface as possible with and a minimum of electrodes through which heat can pass to the outside air.

Radiation loss varies directly as the wall area of the furnace, and cooling-water loss may be said to vary with the number and the size of the electrodes. Two electrodes being the least that can be used for any one furnace, it follows that three single-phase furnaces must have six electrodes whilst a 3-phase furnace of the same total power has only three.

Three electric arc flames acting together in one closed space will give a higher average temperature than the same arcs each at some distance apart and within separate walls each radiating heat. That is to say, a 3-phase furnace of 3,000 K.W. will have less wall area and therefore less radiation than three 1,000 K.W. single-phase furnaces; also the heat absorbed in cooling three electrodes of one furnace will be less than for cooling six electrodes of three separate single-phase furnaces.

Doubling the number of electrodes means doubling the pipe connections and fittings, also electric cables, etc.; and as the water connections must necessarily be connected to the high tension supply, it is an advantage on this account to have as few as possible.

In furnaces with diverging electrodes, heat is principally generated about one-third the way from the bottom, so the cold water should impinge at about that point in order to keep the metal from being worn too rapidly. At the same time, in order not to reduce the temperature of the reaction chamber too much, it is necessary to carefully adjust the amount of cooling water.

Electrodes

The writer's conception of a blown-arc flame is that it consists of arc threads or streamers, which strike across the bottom of the electrodes, and then acting like flexible conductors are carried up by the air current. The ends move rapidly over the surface of the elecrodes until the arcs have reached the maximum length at which the voltage will sustain them, when they snap suddenly and new arcs are started.

If the formations and extinctions of the arc threads synchronize exactly with the alternations of the electric current, then the furnace is working smoothly and it is easy for those accustomed to such furnaces to know this by the sound.

Round each arc-thread there is a flame of burning nitrogen, and as nitric oxide forms it diffuses away into surrounding air and in so doing becomes cooled. Probably the quickest chilling takes place at the moment when each arc-thread breaks.

The arc also tears particles of metal from the electrodes, and these becoming incandescent and oxidized may play some part in expediting or retarding the reaction, for it is known that some metals are better than others, from the point of view of yield of nitric acid.

With diverging electrodes, the ends of the arcs travel along the surfaces in leaps, which is possibly due to softening of the metal, and the arc is momentarily held at each point until the force of the air (or magnetism in the Birkeland-Eyde furnace) overcomes the adhesive tendency.

When the surfaces of electrodes are large, the wear is relatively slow and the electrodes only need renewal at long intervals On the other hand, when the arcs spring from the end of an electrode, as in a Schoenherr furnace, burning is intensive and the electrode has to be fed forward regularly.

The electrodes must be of a metal which has a high melting point and is not readily oxidized, also it should be a good heat conductor so as to pass heat quickly to the cooling water.

Steel is used in the Scheonherr and Moscicki furnaces, but it is not a good metal because the magnetic oxide of iron to which it burns may be carried over to the absorption towers and stain the acid. Steel begins to oxidize at about 370° C., and oxidizes rapidly at about 500° C.

Nickel has an ignition temperature of about 650° C., but it is too expensive to use, and this remark also applies to many metals

and materials which have high melting points, platinum for instance. Those working on the nitrogen fixation problem are always on the lookout for better electodes.

In this connection, the process called "Calorizing" is of interest because it increases the heat resistance of metals. The process depends on the fact that at high temperature and in a neutral atmosphere powdered aluminum will enter into combination with a metal and form a homogeneous alloy which cannot be destroyed except as part of the mass of which it is part. Depth of the impregnation depends on the length of time of treatment, and by it the oxidizing temperature of steel can be raised to over 1,000° C.

Copper is a good metal to use for electrodes, because it is easily made to the required shape and wears away smoothly without releasing troublesome vapors. After a run with some copper electrodes which were fixed by steel screws, having their countersunk heads in line with the path of the flame, it was noted that the steel was considerably burnt, whereas the surrounding copper had only slight surface marks.

It is important to minimize the oxidation, because when a considerable amount of electric energy is employed in vaporizing metal then there is so much less energy for exciting the gas molecules and bringing about the nitric oxide reaction.

Birkeland-Eyde furnaces use tubes of pure electrolytic copper about 2 inches (5 cm.) in diameter and 3/16 inch (5 mm.) thick, bent into the form of a U, each leg of which is about 8 feet (2.4 m.) long.

Electrodes of copper alloyed with other metals have been used to advantage, and those metals which show good nitrogen bands in the arc spectrum are obviously the better ones to employ.

There is some reason to suppose that the presence of metals or oxide of metals act in a catalytic way in increasing the velocity of the reaction. The action of a catalyst is suppose to be such as to make it unnecessary to use higher temperature to get a workable velocity.

(Concluded in Next Issue.)

The financial year of the Coniagas Mines, Ltd., ended last month and is reported to be very satisfactory. The production of silver will be about 1,200,000 oz. The Coniagas bagan production in 1905. To date, approximately 26,500,000 ounces of silver has been produced from the company's original 40 acres in the heart of the Cobalt group. Exploration of the Company's Ankerite mine is continuing with good results.

By an Order-in-Council passed on October 12the the War Trade Board is authorized to take possession of and control for a period of five years any chrome ore areas in Canada, compensation therefor to be determined by the War Trade Board subject to an appeal to the Exchequer Court of Canada. This action is the result of the shortage of chrome ore fro the essential requirements in Canada and allied countries.

An oil flotation plant of 100 tons capacity is being installed at the Indian Peninsula Company's molybdenite mine at Amas, Que. It was first intended to bulid a 30 ton unit, but it has been decided that there is sufficient ore in sight to build the 100 plant which will be ready for operation in the spring. The Dorr Co. of N.Y. are furnishing some of the special machines.

Japanese Chemical Association

The Association was formally inaugurated at the first Exhibition of Chemical Products held at Tokyo in November 1917. High officials including the Emperor attended in person—A second general meeting was held in May, 1918, at Osaka and gave evidence of the closest relationship existing between the Government and Chemical Industries. Free trade, no taxation, and direct government co-operation was requested. Some ten resoitions to this effect were submitted and carried. A bureau was established for the purpose of preparing full statistics concerning all Japanese chemical industries and their products.

FERRO-ALLOYS OF INTEREST TO CANADIANS

By J. W. Richards*

A large industry has grown up within the last fifty years, most of it within the last twenty-five years, which furnishes to steel makers alloys of iron with some of the rarer metals, in order to introduce these rare metals into steel. Such alloys are known as ferro-alloys, because they all contain iron (ferrum); some of them, however, contain more of the rare metal than iron. They were originally made in crucibles, cupolas or blast-furnaces, but are now made principally in electric furnaces, and their manufacture is one of the principal electric-furnace industries.

They are of great importance to the steel industry. The steel maker uses them for one or two purposes: (1) As reagents to take oxygen out of melted steel and thus insure sound solid casting (ferromanganese, ferrosilicon, ferroaluminium); or (2) to put into the steel a small or large percentage of the rare metal (ferromanagnese, ferrochromium, ferrotungsten, ferromolybdenum, ferrovanadium, ferrotitanium, ferrouranium, ferroboron).

Let us discuss briefly these two uses. Melted steel just before taking from the furnace, always contains some oxygen dissolved in it (like the dissolved gas in charged soda water). If this is not removed, the casting made is more or less unsound from cavities or blow-holes. The addition of a small amount of a metal with a high affinity for oxygen removes this element and makes the casting sound. Manganese (1 per cent. or less) is the cheapest and most generally used reagent for accomplishing this; silicon (½ per cent. or less) is more powerful but also more expensive, and is often used to supplement the action of manganese; aluminium (0.1 per cent. or less) is still more powerful and still more expensive, and is used in very small quantities as a final addition to complete the action of the manganese and silicon. All steel makers use one, two or all three of these reagents; manganese and silicon in the form of ferro-alloys, aluminium more often as the pure metal, but ferro-aluminium is sometimes used.

The second use is to make special steels, that is, steels containing such quantities of the rare metal as give to them properties different from plain carbon steels deoxidized by manganese, silicon or aluminium. Thus we may make manganese steel by putting in 12 to 14 per cent. of manganese, making a very tough, hard steel such as is used in mining and grinding machinery, burglar-proof vaults, etc.; chromium (2 to 4 per cent.) makes a very hard tool steel; tungsten (15 to 25 per cent.) makes high-speed tool steel, which cuts iron while red-hot; molybdenum (6 to 10 per cent.) has powers similar to tungsten, and is also used in steel for lining large guns. Vanadium (1/10 to ½ per cent.) makes very strong steel which resists shock extremely well, as when used for automobile axles; titanium, uranium and boron impart valuable properties not so easily described. Every one of these materials is used for producing some specific result which is not produced by any other; sometimes combinations of two, three or four are used in one steel, producing a particular combination of special properties for some special purpose. Some of these materials cost $5 per pound, and the special steels produced cost up to $2.50 per pound, but their particularly valuable properties justify the expense. The value of these special steels to the industries, and particularly for military purposes, is very great, so great that the supply of ferro-alloys for their manufacture is an important factor in winning the war.

Ferromanganese

This is the oldest of the ferro-alloys. Its manufacture was begun about 50 years ago. It was first made in crucibles, has for a long time been made in blast-furnaces, but is now being produced in many places in electric furnaces. It is made with 30 to

*Part of a paper read at the Fourth National Exposition of Chemical Industries, New York. Dr. Richards is Professor of Metallurgy in Lehigh University; Secretary, American Electrochemical Society: Member U.S. Naval Consulting Board.

85 per cent. manganese, 3 to 5 per cent. carbon, a little silicon and the rest iron. The rich grades, 75 to 85 per cent., are preferred by the steel maker, but they require rich manganese ores for their manufacture. The United States has very little rich manganese ore, but large quantities of low-grade ores; one of the present burdens of the steel maker is to use low-grade ferromanganese, in order that we may not have to use ships for importing the high-grade ores from Brazil.

The usual manufacture in blast-furnaces is wasteful of both fuel and manganese; the furnace must be run hot and slowly, with very hot blast in order to reduce the manganese oxide ore as completely as possible and not waste manganese in the slag. Yet, in spite of all efforts, from 15 to 25 per cent. of the manganese going into the furnace escapes reduction and is lost in the slag. This waste of fuel and manganese has led to the use of the electric furnace in which fuel is required only as a chemical reagent and not to produce heat, thus saving about two-thirds the fuel requirements of the blast furnace, while the higher temperature available causes the extraction of manganese to reach 90 per cent., i.e., slag losses to be down to 10 per cent. or less. Against these economies must be set the considerable expense for electric power and the smaller scale on which the furnaces run. At the present high prices of coke and manganese ore, and in view of the scarcity of manganese and the high price of ferromanganese, the electric ferromanganese industry is able to exist and make large profits. Whether it can do so when normal conditions return, after the war, is questionable; it is to be hoped that it will be able to do so, because of the economy which it undoubtedly possesses in regard to fuel and manganese.

Steel producers use ferromanganese particularly for making the low carbon or soft steels, because they can thus introduce the required manganese for de-oxidation without putting in considerable carbon. For higher carbon steels spiegeleisen (15 to 20 per cent. manganese), a cheap blast-furnace alloy, can be used, and is being used at present wherever practicable, in order to save ferromanganese. The best practice with either spiegeleisen or ferromanganese is to melt them in a small electric furnace, and tap from it the required weight to be added to the heat of steel. The melted alloy mixes quicker with and reacts more actively upon the melted steel, while less of it is necessary because less is oxidized by the furnace gases. The saving in manganese by the use of the electrically-melted ferro is alone sufficient to justify the expense of melting it in an electric furnace, while better and more homogeneous steel is produced.

Ferrosilicon

This alloy may run 15 to 90 per cent. silicon, but the most oommonly used is the 50 per cent. grade. It is made from crdinary silica (quartz or sand), reduced by carbon in the presence of iron ore or scrap iron. The blast furnace is able to make only the lowest (15 per cent.) grade, because silica is exceptionally difficult to reduce, and under conditions which would reduce 99 per cent. of the iron ore in a furnace, or 75 per cent. of the manganese ore, only 15 to 20 per cent. of the silica present can be reduced, and only a low-grade silicon alloy produced. The higher grades must all be produced in the electric furnace.

The raw materials are ordinary silica, the most abundant metallic oxide on the earth's surface, iron ore or scrap iron (iron or steel turnings or punchings), and coke. Electric furnaces up to 10,000 h.p. have been operated on ferrosilicon (50 per cent. grade). At the high temperature required, a not inconsiderable proportion of the reduced silicon vaporizes, and burns outside the furnace with a white silica smoke. This can be largely prevented by skillful furnace supervision. In normal times, the 50 per cent. alloy sells at $45 to $50 per ton, which is a low price for an alloy so difficult to produce.

Steel producers use ferrosilicon principally for the great activity with which the silicon removes dissolved oxygen from the steel. It is about four times as active as manganese in thus reducing blow-holes and producing sound castings. It is usual, however, to use manganese first, to do the bulk of the deoxidation, and silicon afterwards to finish up the reaction more completely. It is particularly useful in making sound steel castings which are cast into their ultimate form and do not have to be worked into shape, because a slight excess of silicon may make the steel hard to forge or roll, whereas an excess of manganese does not have so bad an effect on the working qualities. A particular kind of steel called silicon steel carries 1 to 2 per cent. of silicon and yet forges well; this would be classed as a special steel.

The ferrosilicon industry has attained large proportions in countries where electric power is cheap, particularly therefore in Switzerland, the French Alps, Norway, Canada and parts of the United States. Under present conditions it is even profitably run where electric power is relatively dear, as at Anniston, Ala., and Baltimore, Md. It is a large, interesting, and rapidly growing industry.

Ferroaluminium

This alloy, with 10 to 20 per cent. of aluminium, was made in the electric furnace and used in considerable quantity in steel about 1885-88, but was displaced by pure aluminium as the latter became cheaper. Aluminium is about seven times as powerful as silicon and twenty-eight times as strong as manganese in acting upon the oxygen dissolved in steel; therefore only minute quantities are necessary, say one ounce up to a maximum of one pound of aluminium per ton of steel. Its use gives the finishing touch to the de-oxidation of the steel.

About 1885 the Cowles brothers, operating the first large electrical furnaces run in America, at Lockport, New York, made and sold considerable quantities of ferroaluminium, selling the aluminium in it at the rate of about $2 per pound, while the pure metal was then costing $5. When, a few years later, pure aluminium sold for 50 cents per pound, the steel makers turned to using the pure metal instead of ferroaluminium, and at the present time aluminium is so used in practically every steel works in the world.

There seems to me a distinct opportunity for makers of ferroalloys to revive the manufacture and sale of ferroaluminium. Such great advances have been made in the construction and operation of large electric furnaces since 1890, and so much experience has been had in reducing the difficult oxides to ferroalloys, that the production of 50 per cent. ferroaluminium at, say, $100 per ton may be a distinct electric furnace possibility. That would furnish the contained aluminium at about 10 cents per pound, as against 30 cents for the commercial aluminium now used. The alloy should be broken up small before using, and thrown in the runner or on the bottom of the ladle, in order that the melted steel may quickly dissolve it as it runs into the ladle.

Such ferroaluminium would require bauxite with iron ore or scrap iron, for its manufacture, but there are large deposits of low-grade bauxite rich in iron, in Southern France, which could be reduced directly to the alloy without any additions, and thus furnish very cheap raw material for the operation.

In conclusion, ferroaluminium is not now being made, but its electric furnace production is a real possibility.

Ferrochromium

Ferrochromium is used for making what is familiarly but erroneously called "chrome steel." It makes steel exceedingly hard. Very hard cutting tools, and armor plates to resist projectiles, are made of it. Only 2 to 4 per cent. of chromium may be used.

Several grades are made in the electric furnace, depending on the per cent. of chromium (25 to 75), and the content of carbon (2 to 8 per cent.). This alloy takes up carbon so actively in the furnace that it has to be treated subsequently to remove the carbon down to what can be endured by the steel into which it is introduced.

The raw material for its manufacture is chromite, an oxide ore of both chromium and iron. If this is mixed with carbon and smelted in the electric furnace, it reduces directly to ferro-

chromium alloy (often misnamed "ferro-chrome"), and highly saturated with carbon (6 to 10 per cent.). Steel makers want lower carbon than this, so the alloy is re-melted with more chromite in another furnace, and the excess of carbon oxidized out. The low-carbon alloy sells for 2 to 3 times the price of the high-carbon crude material.

The cutting-off of importations of high-grade chromite ore from Asia Minor has led to intense prospecting in the United States. Fair material has been found in many places, and at present our country is nearly independent of foreign sources of the ore.

Ferrotungsten

Tungsten (also called wolfram) imparts curious and valuable properties to steel. A small amount (2 to 5 per cent.) has been used for half a century or more, to make the steel self-hardening; that is, a tool of this steel need only be let cool in the air, and it becomes hard without the ordinary quenching or chilling operation. Larger proportions (10 to 25 per cent.) make a steel which stays hard even when red hot. A tool of this material can be run so fast on a lathe, for instance, that it gets red-hot from the friction and work, yet keeps hard and keeps on cutting. It is called high-speed tool steel, and its use alone has more than doubled the output capacity of the machine shops of the world.

The ore used is either wolframite, a black oxide of iron and tungsten, or scheelite, a white oxide of calcium and tungsten. It is found in considerable quantities in Colorado, and some other Western States, and imports of this ore have not been necessary during the war. In this respect we are much more favorably situated than the European nations. A plentiful supply of tungsten ore may indeed be regarded as a large factor in the production of cannon and fire-arms and all kinds of machinery, and therefore a considerable factor in winning the war.

Ferromolybdenum

Molybdenum has only recently come into large use in steel. Its action being somewhat similar to that of tungsten, scarcity of the latter metal, particularly in Europe, has led to the manufacture of ferromolybdenum on a comparatively large scale.

The ores are widely distributed but not very plentiful. Molybdenum sulphide, molybdenite, looks almost exactly like shiny graphite but is a shade lighter in color and nearly twice as heavy. It occurs usually as flakes in granite rock and might easily be mistaken for graphite. Lead molybdate, wulfenite, is a compound of lead and molybdenum oxides, a very prettily crystallized yellow to red mineral in thin square plates. It occurs abundantly in a few lead mines in the West. It is usually first treated to extract its lead, and the residue then worked for molybdenum. The sulphide used to be roasted to molybdenum oxides, and this reduced by carbon in the presence of iron ore or scrap iron in an electric furnace. It is now smelted directly in the electric furnace with carbon and a large excess of lime along with iron ore or scrap iron. Ferro with 50 to 60 per cent. of molybdenum is tapped from the furnace like other ferro-alloys, but with molybdenum up to 80 per cent. the alloy has such a high melting point that it cannot be tapped out without freezing; it is necessary to make a furnace full of this alloy and then let the furnace cool down and take it apart, taking out a large mass of solidified alloy; the furnace is then rebuilt.

The large use of molybdenum in steel has been so recent that not much has been made public about it. Rumor says that the larger German guns which bombarded Liege (the "Black Berthas") were lined with molybdenum steel (6 to 7 per cent.) to increase their resistance to erosion. It seems certain that Germany drew considerable supplies of molybdenite from Norway to compensate for shortage of tungsten for high-speed tool steel. Parts of guns, gun carriages, motors, automobiles, have also been made of molybdenum steel of most excellent quality. Canada has been especially active in the manufacture of ferro-molybdenum steel, most of which is exported to Europe. This alloy is therefore another valuable war material.

Ferrovanadium

Without vanadium the modern automobile or auto-truck would be a much weaker machine. When steel is desired to withstand the heaviest shocks and vibration, nothing is quite so effective as adding vanadium. There is another comparatively rare metal, found principally in the radium ores of Colorado and as a black sulphide on the highlands of Peru. The canary yellow Colorado ore is treated for radium, and the residues for vanadium and uranium. The U. S. Government (Bureau of Mines) operated this process for the radium supply. The black ore of Peru is rich and unusual; it is a sulphide with some asphaltic matter, and it is roasted to the condition of iron-vanadium oxide before reduction. The oxides are best reduced by metallic aluminium. This is the well-known thermit (Goldschmidt) method of reduction. Electric furnace reduction by carbon is not advantageous because of the large amount of carbon taken up by the alloy; powdered silicon is therefore put into the charge as the reducing agent, together with iron, lime and fluorspar, and then a 30 to 40 per cent. vanadium alloy is obtained with seldom over 1 per cent. of carbon, a very desirable composition (R. M. Keeney).

Only small amounts of vanadium are necessary to improve steel; 0.1 to 0.4 per cent. are the usual quantities. This is fortunate because the vanadium costs $5 per pound and over. Metallurgists suspect that part of the improvement of the steel may be due to the vanadium combining with and removing nitrogen dissolved in the melted steel. This is probably true, yet some advantage undoubtedly must be ascribed to the final vanadium content in the steel; both avenues of improvement function. Steels thus treated are unusually resistant to shock and alternate stresses, making them very useful for axles, cranks, piston-rods, and such severe service.

Ferrotitanium

Titanium is an abundant element in nature. It occurs in immense amounts as a double oxide of titanium and iron, known as ilmenite, or titanic iron ore. This ore can be reduced directly by carbon in electric furnaces to ferrotitanium. The reduction proceeds easier if some aluminium is put in as a reducing agent, but this is expensive and unnecessary. The alloy running 15 to 25 per cent. titanium is sold for use in steel as a refining agent to remove oxygen and nitrogen. Thousands of tons of steel for rails has been thus treated, the tests showing considerable improvement in the mechanical properties by the use of quite small amounts (0.10 to 0.20 per cent.) of titanium.

Ferroboron

This is another alloy whose valuable qualities have not yet been entirely determined. Boron is the metallic base of borax, which is a sodiumboron oxide. Borax is very difficult to reduce to the metallic state. Another raw material, not so abundant, is colemanite, containing lime and boron oxide. Many attempts have been made, none very successfully, to reduce this with iron oxide to ferroboron. The American Borax Co. offered a prize, for several years, for a process which would accomplish this. Boron oxide occurs rarely in nature, but it can also be manufactured from borax and colemanite. When the oxide is obtained, this can be combined with iron oxide and the resultant boron-iron compound reduced by carbon in the electric furnace to ferroboron. Small quantities of this alloy have thus been manufactured.

Experiments on steel have shown that ferroboron acts somewhat similarly to ferrovanadium. Experiments in France showed remarkably strong and tough steels were thus made, using 0.5 to 2 per cent. of boron. The results have not been properly followed up, partly on account of the difficulty in getting ferroboron; no one, as yet, has taken up its regular manufacture and steel makers can hardly be blamed in these stirring times for not having as yet thoroughly explored its possibilities as an addition to steel.

Ferro-Uranium

This is the latest of the ferro-alloys to enter the lists. Uranium

is a very heavy and, chemically, very active element. It is found very scarcely as a black oxide, the mineral pitchblende—the mineral in which radium was first discovered. It is found more abundantly in the Colorado radium ore, a bright yellow oxide and silicate of vanadium, uranium and lime. After extracting the radium and vanadium, the uranium remains in the residue as a by-product, usually as a soda-uranium compound. This is treated so that uranium oxide is obtained, and this can be re-reduced by carbon in an electric furnace in the presence of iron ore or scrap iron, to ferrouranium (30 to 60 per cent.). The recovery of uranium is not high (50 to 70 per cent.), the rest being lost in the slag. Mr. R. M. Keeney has recently described these processes in detail, for the first time in the August Bulletin of the American Institute of Mining Engineers.

The results of tests showing the influence of uranium on steel are not yet completely known. Some firms have claimed for it wonderful strengthening power and resistance to shock. The subject is still receiving expert attention from steel makers, and valuable results are confidently expected.

Conclusion

The ferro-alloys are exceedingly important materials to the steel maker, either in the making of ordinary steeel or for producing special alloy steels. They are indispensable to the steel industry. They are important factors in producing both ordinary and fine steels, and therefore in winning the war. The country well supplied with them has a great advantage over the country in which they are scarce. They are deserving of all the expert attention which they are receiving from the War Industries Board, the steel makers, and the economists.

CHEMICAL PRODUCTS FROM SEAWEED

"The Chemical Color and Oil Daily," of Sept. 26th, contains the following paragraph: "Swedish seaweed obtained by the Germans has been converted chemically into fodder, besides supplying valuable chemicals. An investigation has been made at Stockholm, and has suggested various products for a projected large home factory. Besides illuminating gas, the obtainable materials from the seaweed include carbon, acetic acid, methylated spirit, formic acid, sodium sulphate, potassium sulphate, potassium chloride, iodine, bromine, a very aromatic tar, and a tarry product suitable for preserving wood or timber."

The Trade Commissioner for New Zealand reports that arrangements have been made to ship to his country from Canada a quantity of soda ash, to be used as a substitute for caustic soda in the manufacture of soap, local stocks of the caustic soda having become almost exhausted.—(Weekly Bulletin, Sept. 23.)

HUGE EXPORTS FROM THIS CONTINENT

For the year ending July 1st, 1919, the Allies look to the American Continent for 17,550,000 tons of meats, fats, sugar, feed grain and bread stuffs. This means 5,730,000 tons more than was shipped in the year ending July 1st, 1918, and the surplus alone is 197,000 tons greater than the entire shipments based upon the average for the three years before the war. Conservation and production are absolutely essential in Canada. We are off to a good start, however, as an item of some 125,000 cases of condensed milk shipped from Canada during August would show. This is a new record.

BRITISH PHOSPHATE RESOURCES

The famous nitrate of soda areas of Chile, the output of which was formerly monopolized by Germany, may now be rivalled, as a source of fertilizer, by the vast deposits of phosphate rock found on Nauru Island and Ocean Island, captured from Germany early in the war. These islands lie half way between the Marshall and Solomon groups and are being administered by Australia and New Zealand. The islands are of coral formation and have been for ages the haunts of sea birds, whose deposits of guano during many ages have turned the lime into phosphate rock to a depth of forty feet.

CANADA AND ELECTRO CHEMISTRY

By Francis A. J. FitzGerald, A.I.E.E., Niagara Falls

II.—Electric Energy from Water and Steam

(Continued from September Issue.)

In the early days of the development of hydro-electric generating plants, like those at Niagara Falls, the people interested in the installation probably gave but secondary consideration to electro-chemical industries as customers. In those days the point of view was probably that of the ordinary central station with steam generated power which supplied current for electric lighting, for street cars, for manufacturing plants using motor driven machinery, etc. Industrial electro-chemistry was in its infancy and was hardly developed to a point where it was regarded as the most important user of hydro-electric power. At that time also steam-electric energy was relatively costly when compared with present day practice. In considering the use of Canadian water powers it is necessary to be informed as to the present status of steam-electric power. Probably the latest and best presentation of this subject as it interests electro-chemists is to be found in an address on "The Production of Electricity by Steam Power," which was delivered at the Pittsburgh meeting of the American Electro-chemical Society, October 4, 1917, by Mr. Alex Dow, and which will be printed in Volume XXXII. of the Transactions. As regards steam power, much of what follows is based on this authoritative presentation.

The first point on which stress should be laid in regard to electric power from whatever source is that the cost of the power that we are interested in is its cost delivered at the point where it is to be used. In a close network the delivered power may be 90 or 92 per cent. of the generated power, but in a system covering a large area and delivering power in different forms, if the delivered power is 80 per cent. of the generated power the practice is excellent and under certain conditions distribution efficiency of as low as 75 per cent. may still be as high as can be reached commercially.

In the steam-electric plant the big factor is the cost of fuel. In examples given by Mr. Dow in regard to the costs per kilowatt-hour of net output, i.e., the energy metered to the outgoing trunk lines, it appears that in the twelve months ending June 30, 1916, the fuel cost was 63 per cent. of the total running cost, that is operation and maintenance. At the end of the 12 months ending June 30, 1917 the fuel cost was 72 per cent. of the total cost, the fuel cost per kilowatt hour during the second twelve months had increased 52 per cent.

It is from considerations like this in regard to fuel cost that it is such a common error to jump at the conclusion that hydro-electric power must be more economical than steam-electric power. But this is largely because people overlook the very important question of the nature of the load and also forget the item of distribution efficiency and cost of distribution.

The load factor, that is to say the ratio between the average demand for power and the maximum demand, varies enormously according to the nature of the load. The load factor in the case of residence lighting may be estimated at 8 per cent., street car lines may have a load factor of 15 to 25 per cent., and street lighting in small towns a factor of 15 per cent. Large stations are doing very well indeed if they have a load factor of 40 per cent. On the other hand, the load factor of an electro-chemical plant should be in the neighbourhood of 90 to 100 per cent. under normal conditions. For obvious reasons in electro-chemical processes the loss involved in running at less than full load is a serious one, and therefore the electro-chemical plant must always try to run as near full capacity as possible.

As an example which will show this in concrete form, imagine an electric furnace process in which the thermal efficiency of the furnace is 60 per cent., i.e., 60 per cent. of the energy is doing useful work while the other 40 per cent. is merely supplying losses by heat radiation, conduction, etc. It is obvious that

this loss of energy is constant since it must be used, no matter what the output of the furnace is, merely to keep the furnace at the working temperature. Suppose then that the power on the furnace is allowed to drop 20 per cent. below normal, then the output will be cut down one-third or if the power is cut down by 30 per cent. the output is reduced 50 per cent.

The most marked characteristic then of the electro-chemical plant as a user of electric power is its high load factor, thus representing the opposite end of the scale from residence lighting with its low power factor of 8 per cent. If we compare the cost of supplying electric energy to an electro-chemical plant and to a residence for lighting we find in the case of a steam electric plant that for the electro-chemical plant fuel cost is by far the most important item making up the total cost while in lighting a residence the fuel cost is a small item, the total cost being made up nearly altogether of fixed charges.

Another important consideration in relation to steam-electric and hydro-electric plants is the cost of transmission. If we have a waterfall as a source of electric energy there is no way of getting that energy to the consumer other than by means of an electric transmission line, but if we have a coal mine as our source of energy we have the choice of putting the electric plant at the coal mine and transmitting electric energy or we can haul coal by rail to a steam plant near the consumer. In the case of the coal mine then we can calculate whether the transmission cost is greater or less than the cost of hauling coal. Mr. Dow, in the address referred to above, has some interesting remarks on this subject:

"The right-of-way of your transmission lines is an item of high cost. The line loss may be a high cost. Some interesting figures were obtained when I was asked to furnish the comparative American costs of electric transmission of energy from coal mines against railroad movement of coal, for comparison with possible English costs, with an assumed line loss of 15 per cent. The preliminary result of the comparison is that England cannot move energy by freight train as cheaply as by electric transmission lines, while American freight trains hauling short tons of coal at something like one-third of a cent per mile, can move it more cheaply than the transmission lines. There you see how you must balance one thing against the other."

The economic questions involved in any system of electric generation are, as shown by what has gone before, very complicated and when these are taken into consideration the real economy of hydro-electric generation is found to be a subject calling for very careful study. The following quotations will show what are the conclusions to be drawn from such a study:

"It is natural for a spectator surveying a hydro-electric development to gain the impression that the power comes from the water, which, costing nothing, should render the power cheap. It is evident even to a spectator that outside of bond interest the operating expenses of a water power are relatively very low, being in our typical case only 22.5 per cent. of the total, which includes ample allowance for depreciation, taxes and insurance. But so much of a dam is in hidden foundations and in parts under water and so much of the long transmission line, rights-of-way and power house substations is out of view that a spectator, even though liberally minded towards the deserts of capital constantly under-estimates the amount of capital invested and neglects to include in his conception of the cost of the power, adequate charges for the service of the capital.

"Business men know that profits depend not only upon excess of price over cost of product, but on 'turn-over,' which is the ratio of aggregate sales to capital.

"If we compare a steam-electric with a hydro-electric power of the same capacity in both of which the selling price of a horse-power-hour is the same, we must permit of this selling price a greater proportion of gross profit in the hydro-electric or we cannot yield the same return to capital, since there is three times the capital to be served. In other words, there is only one-third of the 'turn-over.' The activity of capital in a hydro electric plant is very low, much lower than in a steam station, and much lower than in almost all other branches of industry such as manufacturing."(1)

"How can we get power cheaper? Is there any way in which we can develop power cheaper than it is being developed at present, which will admit of the development of the electro-chemical processes? If we go back perhaps we will see why the electro-chemical industries to-day are tending to move away from Niagara Falls.

"Fifteen years ago Niagara Falls was unquestionably producing power more cheaply by water than by any other method which could be found in this country. In the meantime the evolution of hydro-electric equipment has gone on quite slowly, as it had a very high initial efficiency. Let us look, on the other hand, at the steam plant. The hydro-electric plant, let us say, has made 10 per cent. advance in fifteen years, but in capital cost it has not made any advance at all, if anything the capital cost has gone up, as the cost of labor and material has run up.

"Let us look at the steam plant. To begin with, the capital cost of the steam plant in fifteen years has been a little more than cut in two. The next point is that the steam plant is now making power with approximately one-half the coal required fifteen years ago. Those are two enormous points of advantage.

"I was very much interested in going over a situation recently which involved tacking on, as it were, a steam plant to a large hydro-electric system. It fell to my work to look into the economics of the situation as well as the engineering possibilities. After going into the situation carefuly I came to the conclusion that up to a certain load factor we can to-day produce power more cheaply, with a lower overall cost (including fixed charges and operating cost), by a steam plant than we can by any hydro-electric plant now in existence applied to this particular case.

"The overall costs of power were approximately equal at a load factor of 60 per cent. Above that the hydro-electric plant began to show a little better results than the steam plant. Below that point the steam plant was better relatively as the load factor went down.

"Now what we learn from these facts, is simply this—that if we want to produce power at a lower cost than we can do to-day by hydro-electric plants, we must use some combination of steam and hydro-electric power, the steam plant for the peak loads and the hydro-electric power for that part of the load having load factors of over 60 per cent." (2)

This review of the production of electric energy from water and steam gives the answer to a question that is often asked: Why is there not a greater utilization of water power for the generation of electricity? The answer is, of course, that the use of steam is more economical so far as concerns ordinary loads which a power plant has to supply. The ordinary users of electric power have load factors which average something like 40 to 50 per cent. while the electro-chemical user is almost the only user whose load factor approaches fairly close to 100 per cent.

In these considerations the question of immediate economy has alone been kept in view. The problem of the necessity of conserving our fuel resources has been ignored. Our fuel supplies, i.e., coal, oil, gas, etc., are not inexhaustible and the question may well be asked: Should we develop our inexhaustible water powers as sources of electric energy for the express purpose of conserving our fuel supply? If the answer to this question is affirmative then we must be prepared to pay the increased cost of using a more expensive source of energy for ordinary purposes.

Finally it must be noted that the figures given above as to economical load factors, etc., apply to normal conditions and not to the abnormal conditions of a world at war. Were calcula-

(1) "The Water Power Situation, including its financial aspect,,' by Gano Dunn, Proceedings of the American Institute of Electrical Engineers. Vol. XXXV., 5, p. 586.

(2) Henry G. Stott, Ibid, Vol.XXXV. 7, p. 1135 et seq.; Gando Dunn Ibid, Vol. XXXV., 7, p. 1137.

tions to be made under conditions as they actually exist to-day, some of the figures given would have to be altered, but the general principles and the conclusions arrived at would not be affected.

(The third article by Mr. FitzGerald will deal with what might be called the great Hydro-Electric Experiment of the Province of Ontario.)

THE ELECTRIC FURNACE AFTER THE WAR*

By Francis A. J. FitzGerald

*Paper delivered at the 34th meeting of the American Electro-Chemical Society, Atlantic City, Oct. 2, 1918.

The following remarks on the electric furnace after the war do not pretend to be anything more than, first, some observations on the status of the electric furnace to-day in certain industries with an attempt to deduce what is likely to result therefrom after the war, and second, a note on the profound effect certain social tendencies which are strongly affected by the war, are apt to have on electric furnace development.

War conditions have enormously increased the use of the electric furnace, not only in work where it was already used, but where, before the war, it was not used at all or had only been tentatively adopted. As examples of the increased use of furnaces in work where they were previously used we have the ferro-alloys, steel, abrasives, amorphous carbon and graphite electrodes and in the case of work where their use was not important before the war we have ferro-manganese, pig iron, brass and bronze melting, heat treatment of metals, forging, etc.

In the ferro-alloy work the increase in electric furnaces is not only found in the factories of those who previously were engaged in this industry, but all sorts and conditions of men, who would never have thought of doing such a thing but for the war, have taken up this class of work. The condition as regards the manufacture of abrasive materials is similar. It is safe to say that some of these activities will cease after the war, for even at this time, in spite of favorable conditions, some have stumbled if not fallen by the wayside.

The use of electric furnaces for steel has been greatly stimulated by the war. This is well illustrated by the number of electric steel furnaces with patented features of various kinds, which apparently are prospering sufficiently to advertise widely. It is probable that the use of steel furnaces would be even greater were it not for the difficulty of getting electrodes and materials for furnace construction.

An obvious hindrance to an even more rapid growth in the use of the electric furnace than actually exists is the relatively small number of experienced electric furnace workers. The electric furnace is too new an apparatus to have provided numerous men trained in its working. The consequence is that there is not, as yet, any standard practice such as is found in other kinds of furnaces which have been in use for many years. Electric furnace practice varies enormously and until there is more experience and more exchange thereof among workers nothing approaching standard practice will be reached. Probably the more severe conditions which will be experienced after the war will bring about this standardization more rapidly.

There is one development of the electric steel furnace which might have been expected as a result of war conditions, but which apparently has not come. This is the use of the induction furnace or its modified form, the Rochling-Rodenhauser furnace. These, not requiring electrodes, would apparently offer a means of getting round the electrode shortage and the very high price of electrodes even when they can be obtained. That the induction furnace has good points besides elimination of electrodes there can be no doubt. For example, its thermal efficiency might be made higher than that of any other steel furnace. But it does not seem to have gone ahead in spite of conditions that appeared favorable, one reason being that a satisfactory refractory lining has not been worked out. The lack of men in this country who are experienced in the peculiatities of the induction furnace naturally hinders attempts at working on the problem, particularly under war conditions which do not encourage spending much time on experiments.

Although it looks as though an excellent opening for the induction steel furnace has been missed during the war, I am convinced that interest in it will revive later, because the principle, at least, has apparently been used successfully in the modification of the Hering furnace for the melting of bronze and brass. Ten or twelve years ago when attempts were made to introduce the induction furnace to this country a great deal of experimenting was carried on with a view to its use for brass and copper melting. This was not successful owing largely to the troublesome pinch effect. Dr. Hering, however, utilized the pinch effect in his furnace and showed me, when we were looking at his furnace at the Ajax Works in Philadelphia, how the pinch effect could be combined with the induction furnace. Since then a furnace working on that principle has been successfully developed.

Owing largely to the shortage of graphite crucibles and the consequent high expense involved, the development of the electric furnace for brass has been greatly stimulated and now there can be no question that electric brass furnaces will be largely employed.

It would be tedious to catalogue all the ways in which the electric furnace is developing, but it is my belief that after the war there will be a still further development for various reasons. One of these is that a large number of people are now being educated in the use and possibilities of the electric furnace. Another reason is that many plants now turning out electric furnace products are only able to do so because of the high prices they get under war conditions. It is almost certain that with the termination of the war a lessened demand or lower prices for many electric furnace products will follow and this will inevitably make some furnace plants apparently useless. This, in turn will stimulate the search for other uses to which the idle plants can be put. Many years ago something of the same kind happened in Europe at the time of the acetylene crisis, when many plants making calcium carbide were shut down owing to patent litigation. This had a marked effect in developing the use of the electric furnace in the manufacture of ferro-alloys, steel, etc.

So far, therefore, as the extensive use of the electric furnace is concerned, it has been greatly increased by war conditions, and for the reasons given it is bound to be still further extended after the war. But when we come to consider the use of electric furnaces in ways that will demand great quantities of power such as the manufacture of nitrates, pig iron, etc., we must take into account certain social tendencies which will have perhaps a controlling influence on their development.

For the successful development of those industries using large quantities of electric energy, water power developments are necessary and no one who is interested in these can have failed to observe the growing popularity of the idea of putting them under government ownership. This is almost certain to interfere with the growth of the electric furnace in the industries considered.

Under an autocratic government state ownership has some possibility of success. Assuming that competent men who take a keen interest in their work are in charge of a government hydro-electric development there is no reason why it should not be worked on good principles so lon gas that is the desire of the government. Those in charge must satisfy their employer very much as though they were in charge of a privately owned enterprise and had to satisfy their employers, the stock holders. The case, however, is very different under a democratic government. Here the people are the employers, taking the place of the stock holders in the privately owned enterprise, and the government must satisfy them or rather the majority of the voters. Now, in the case of the privately owned enterprise the stock holders have a very simple measure of the efficiency of their managers—dividends. If these are not satisfactory the stock holders will demand reasons. In the case of government owned

hydro-electric plants there is no measure of this kind. The man who does not use electric current will probably not consider the matter at all, the man who does use current will measure the efficiency of the management by the price he pays for it. The consequence is that the managers of the government owned hydro-electric plant must, if they would hold their jobs, see to it that the majority of the plant's customers get their current at the lowest price possible. Usually the majority of the plant's customers will be small users, the householder, the farmer, etc., and it is evident that these must be satisfied, even at the expense of the small number of customers of the plant who are large users. This is what is bound to happen in the case of government ownership of hydro-electric plants, for the small users, the majority of the voters, will by no means be willing to trust the government in the matter of just rates, they will put in that government which will give them low rates however inequitable and actually injurious these may be. Government ownership of hydro-electric systems is, therefore, the most serious menace to the future of the electric furnace so far as the larger developments are concerned. It will take years to teach the farmer and small householder that the actual cost of supplying them with electric current is enormously greater than that of supplying the factory using thousands of horsepower and that when they get a low price for their current at the expense of the large user it is no real benefit to them since they more than pay for what they save in current by the increased cost of other things just as essential to their lives.

The government ownership of water-powers is only one of many kindred problems which we must face immediately. There is probably yet time to avert the disastrous results which would follow such a policy and fortunately we have in the Ontario Hydro Electric Commission a large scale experiment in government ownership well worthy of study.

We are fighting in a great war between two principles of government: that in which the people exist for the State and that in which the State exists for the people. We have no doubt which side will win; but if as a result of that victory we destroy a Socialistic Autocracy in order to set up ourselves a Bolshevik Bureaucracy the last state of humanity may be worse than the first.

HANDY TECHNICAL STATISTICS

The Yocum Faust Co., Ltd., of London, Ont., manufacturers of oils and specialtles for the Leather, Textile and Shoe trade, have issued a sheet of statistics of practical value to these and other industries. It will be particularly valuable to foremen in charge of special operations. Comparative hydrometer and thermometer scales are printed in good readable type. Much useful information required in the usual daily operations of such trades is also condensed and presented in a form that can be used by workmen in charge.

RECENT INCORPORATIONS

Toronto.—The Arcwell Corporation of Canada, Ltd. Arthur Lorne Reid, solicitor. Capital $1,000,000. Electrical appliances, coal, metals, minerals, oils, nitrates, etc.

Toronto.—United Preservers Sugar Co., Ltd. Andrew W. Hunter, solicitor. Capital $1,000,000. Chemical manufacturers and analysts.

Montreal.—Canadian Industrial Alcohol Co., Ltd. Arthur Ramsey Holden, K.C., solicitor. Capital $5,000,000. Industrial alcohol.

Woodstock.—Woodstock Worsted Spinning Co., Ltd. Robt. N. Ball, solicitor. Capital $100,000. Spinners, bleachers, dyers.

Montreal.—New Brunswick Sulphate Fibre Co., Ltd. John J. Meagher, K.C., solicitor. Capital $600,000. Pulpwood, alcohol, chemicals, minerals and metals.

MONTREAL LETTER

(Correspondence of the Canadian Chemical Journal, By J. C. Ross.)

MONTREAL, Oct. 25th, 1918.

In the chemical trade there cannot be said to be any improvement, while in some lines the situation in regard to supplies is worse than ever. This is particularly true of such commodities as log wood, bleaching powder and bi-carbonate of soda. In the case of log wood a further restriction was put into force on the 10th of this month, which makes it almost impossible for ordinary business houses to get supplies. Many firms have not taken on any new business since August, following out the policy of supplying those who had contracts with them. Prices are likely to go higher, as further supplies cannot be obtained. In the case of bleaching powder the demands of the United States Government comes first. One large local supply house stated that they had been able to get a car through lately, but did not know when they could duplicate it. In regard to bi-carbonate of soda importers must not only have a license, but must have their transactions approved both by the War Trade Board, and the Bureau of Mines. At the present time, there are some supplies coming through from Scotland, but when this is exhausted dealers state that they do not know where to look for further supplies.

The spread of "Spanish Influenza" has put a tremendous demand on the wholesale and retail druggists of the city, and has simply exhausted the supplies of drugs used for gargles, sprays, and disinfectant purposes. From the 1st of October up to the 25th of this month, there were over 14,000 cases of influenza reported in Montreal, and over 2,200 deaths. The demand on wholesale druggists has been so heavy that some of them called in their travellers two weeks ago, and are working day and night in their warehouses to get out sufficient supplies for their customers. In the Province of Quebec, outside Montreal, there were over 63,000 cases reported to the Provincial Health Officer.

A new charter has been secured by the John Cowan Co., Ltd., and hereafter it will be known as the John Cowan Chemical Co., with a capitalization of $200,000. This increased capital will enable them to operate on a larger scale. Already the company have added a number of new lines, to those they were already handling, such as insectives for spraying fruit trees, tomato plants, etc. These new lines will be in the market for next year's business. The firm met with success in the preparation of their arsenate of soda, and are now making ...parations for a powder formula for potato bugs.

Owing to the prevalence of "Spanish Influenza," meetings of all kinds have been put under the ban, consequently there have been no recent meetings of the Chemical Society. This society had made preparations to carry on a series of important meetings during the winter months, but in the meantime these are all in abeyance.

Mr. M. S. Page, of the Timber Testing Division, of the Forest Products Laboratory died a few days ago of Spanish Influenza. Professor James Cronk, of the Engineering Department of McGill also died from the disease, while a large number of the staff of the Forest Products Laboratory and McGill have suffered from it.

A report issued by Mr.Arthur Amos, Chief Hydraulic Engineer of the Provincial Government, shows that there are at the present time 850,000 H.P. in use in this province. This, of course, is only a small fraction of what is available for development, but indicates a very considerable use of white coal.

A few days ago a number of prominent capitalists of Montreal, Ottawa and Renfrew, headed by the Honorable M. J. O'Brien, interviewed the Quebec Cabinet regarding a project to dam the Back River, which flows past the north side of Montreal Island. The undertaking is being planned for the purpose of providing Montreal with an additional 40,000 H.P., and thereby further conserving the use of coal. The project will cost in the neighborhood of $12,000,000.

Canadian Government Publications

By S. J. Cook, B.A., Public Analyst, Department of Trade and Commerce, Ottawa

[NOTICE.—Recent Government publications of scientific, technical, or other educational value, are reviewed here from month to month. Unless otherwise stated, these publications are free, and may be obtained by those interested, upon application to the Department of the Government issuing the same.]

Department of Agriculture

Agricultural Gazette, October, 91 pp. 10c. A symposium from the Provinces on the subject of "Co-operation in the Handling of Wool," together with an introductory editorial on the same topic, form an important feature of this periodical for the current month. The Dairy and Cold Storage Branch news consists of the text of the new regulations under the Dairy Industry Act. The former regulations have been repealed and a new set substituted therefor, to come into effect September 1, 1918. Considerable attention to the subject of branding is noticeable in the new provisions for the control of dairy products. The Entomological Branch contributes a paper on "The Value of High Temperatures in the Control of the Common Bedbug," and a paper on "Injurious Weed Seeds in Feeding Stuffs" comes from the Seeds Branch. This number is also a guide to the Agricultural Periodical Literature, and under the title of "The International Institute of Agriculture," many references are given. Altogether the current issue is of much more general interest than usual.

Commission of Conservation

Conservation of Life, October, 23 pp. Special Town Planning Number. The plan of the new town of Ojibway—a Canadian Steel Corporation town near Windsor—is given, and is explained at some length. The tendency on the part of large manufacturers to build their own towns—a movement which has grown considerably in recent years—is commented on, and the question is raised: "Does it mean that in some respect large cities are so lacking in foresight and so neglectful of their real interests as to be forcing their own disintegration?" Tentative proposals, as a result of work done during the last six months in the planning of the Greater Halifax, are outlined. The schemes are said to be practical from both financial and engineering points of view. There is also an article on "Town Planning in Relation to Public Safety."

Canada Food Board

Canadian Food Bulletin for October, 20 pp. General data on the activities of the Canada Food Board.

Department of the Interior (Dominion Parks Branch)

Description Of and Guide to Jasper Park, 97 pp., 50c. A guidebook for tourists visiting Jasper Park on the Grand Trunk and Canadian Northern Railways in Alberta, has just been issued by the Department of the Interior. It is profusely illustrated and altogether is one of the finest specimens of the printer's art ever issued in Canada.

The park offers many attractions to lovers of the mountains. On the crest of the continent, just south of the Yellowhead Pass, between the Tonquin and Upper Fraser Valleys, is an immense block of abrupt mountains. The contrast between the wide valleys with their alpine meadows and smiling lakes, and the huge black cliffs and hanging glaciers, forms one of the most striking pieces of scenery to be found anywhere in the Rocky Mountains. Mount Edith Cavell, named after the heroic nurse martyr of the Germans, is another notable feature; it is over eleven thousand feet and seems to dominate the whole park. When the beauties of Jasper are better known, it cannot fail to attract many tourists.

The book and the map which accompanies it, are the outcome of a photographic survey of the park by M. P. Bridgland, D.L.S. This method of surveying was introduced in Canada by the Surveyor-General more than thirty years ago, the extent surveyed to date being thirty-two thousand square miles, about the area of Ireland. Until the war, Canada was the only country where the photographic method of surveying was in practical use, the surveys made elsewhere being of an experimental character. or extending at most over a few square miles only. Photographic surveying is now an essential part of the work of the military flying corps of the armies. Photographs are taken from aeroplanes and the enemy's trenches, batteries, railways, etc., are plotted from the photographs. With the experience and training thus acquired, it is to be expected that photographic surveying will come into general use after the war, but to Canada belongs the credit of first recognizing the merits of the method and bringing it into practical application.

Glaciers of the Rockies. A. P. Coleman, M.A., Ph.D., 29 pp. An exceedingly readable and instructive little publication, printed in good style and well illustrated throughout.

Report of the Commissioner of Dominion Parks, 1917. J. B. Harkin, 83 pp. The report of the Commissioner makes thought-provoking reading to one interested in after the war development in Canada. The commercial value of our Canadian National Parks is outlined and as well the human value, the usefulness to the nation of large public playgrounds, is developed. The year's work in review is supplemented by separate reports from the superintendents of the various national parks. Excellent illustrations add much to the pleasure of the reader perusing this report.

Topographical Surveys Branch

Annual Report, 1916-17. The Surveyor-General points out that expenditures in his department for the year are about $269,000 less than in the previous year. Only fifty field parties were sent out during the year. The preliminary part of the report outlines the work of the Branch in detail, and in thirteen appendices, schedules and reports find their place. The work of the Surveys Laboratory is not as well known as it deserves to be. Here transits, tapes, levels, watches, thermometers, etc., are carefully tested along approved lines. Much work for the War Purchasing Commission has been done this year, and in spite of the routine work, several investigations in optical and other lines have been carried out. Canadian manufacturers might make more use of this Laboratory for the testing of thermometers, etc. Two maps illustrating the year's progress accompany the report.

Natural Resources Intelligence Branch

Peace River District. F. H. Kitto, D.L.S., 50 pp., 11 illustrations, 1 map. This little pamphlet descriptive of the resources and opportunities of the Peace River District has enjoyed such a wide distribution that a second printing is about to be made. To those whose thoughts drift to the delightful block of land lying midway between Edmonton and Prince Rupert, this report is satisfactory as an authoritative source of information compiled by one who knows the country well. To others it is an instructive travelogue in good style.

Department of Mines (Mines Branch)

Mineral Springs of Canada. R. T. Elworthy, B.Sc. Bulletin 20, Part 11. The chemical character of some Canadian mineral springs. 173 pp., 10 plates, 2 drawings. This bulletin completes the report of work done by Mr. Elworthy during three years on the subject named. Part 1, reviewed in this journal some months ago dealt with "The Radio-activity of some Canadian Mineral Springs." Iu this publication, which is more chemical in its nature, water analysis, the methods employed, and the interpretation of results form the introductory part. Later the springs visited are described and the analyses found are tabulated. The therapeutic and economic values of the Canadian springs, and

the relation of their chemical constituents to the geological formations are considered at length. The volume, which is a contribution of merit to the subject, concludes with a bibliography of methods for the classification of mineral waters.

Geological Survey

Summary Report, 1917. Part D, 46 pp. A summary of the survey work carried on during 1917, in the following districts: Schist Lake District, Northern Manitoba; Wekuska Lake Area, Northern Manitoba; Gold-Bearing District, S. E. Manitoba; Star Lake Area, Manitoba; Molybdenum, near Falcon Lake, Manitoba; Soil Survey along Hudson Bay Railway; Refractory Clay, etc., Swan River Valley.

Regarding molybdenite, it is pointed out that although the deposits are comparatively easily accessible, the content of metal is low. It is suggested that at the present time commercial working might be possible.

Rainy River District, Ontario. Surficial Geology and Soils. W. A. Johnston, 123 pp., 12 plates, 1 map. (Memoir 82, No. 68, Geol. Series). This report deals with the distribution and character of the different soils of the region which has long been known to be exceptionally different from the rocky Lake Superior District on the one hand and the Manitoba plains on the other. The sediments laid down by the pre-glacial Lake Agassiz add much to the fertility of the soils found here, and as little field work has been done in this region since that of Dr. A. C. Lawson in 1886-87, the present report is of considerable interest. A review of the previous work is followed by chapters on the development and general character of the district, and the data are summarized. The physiography and the geology, descriptive, historical, and economic are treated at length. From the paper it is learned that 33.2 per cent. of the entire area constitutes the occupied land, and of this only 4.6per cent. has been improved. Much of the land is swampy but might be drained. Lumbering as an industry is gradually yielding to agriculture. These are a few of the facts cited.

Department of Trade and Commerce

Advisory Council for Industrial Research

Report No. 2.—The Recovery of Vapors from Gases. Harold S. Davis, M.A and Mary Davis, B.A., 15 pp. Complete text appeared in the September and October numbers of the Journal.

Bulletin No. 3. How to Handle Frozen Fish.

Bulletin No. 4. Hints on Frozen Fish. E. E. Prince, D.Sc., 4 pp. (Both bulletins in one cover.) Description of a brine freezer together with data on the processes used in the freezing of fish successfully for food conservation.

Report of the Administrative Chairman, 40 pp. A general review of the work done, most of which has been reviewed in the Journal throughout the year.

Dood and Drugs Laboratory

Bulletin 408. Medicated Soaps, 35 pp. In order to provide the public with definite information regarding the many varieties of medicated soaps which are on the Canadian market and which are so extensively advertised in the press, 253 samples were collected and examined at the various laboratories of the Department, and the results of analysis together with an illuminating report by Mr. F. C. Collier of the Ottawa Laboratory, are now published in the bulletin named. This is the first paper of importance published in his country on this subject, and it will undoubtedly enjoy a wide distribution. The various processes employed in the manufacture of soaps, descriptions of the several classes of soaps, and a discussion of the therapeutic claims form the principal divisions of the paper, which is in a readable, popular style. Complete analytical data are appended.

Deposits of epsomite are now being developed near Clinton, B.C., by two Vancouver companies. Hitherto the only production of epsomite in British Columbia has been from the Spotted Lakes, in the Osoyoos Mining Division, where last summer the output was about 900 tons.

REGULATIONS REGARDING THE USE OF SACCHARIN AS ISSUED BY THE DEPARTMENT OF TRADE AND COMMERCE

Ottawa, 19th September, 1918.

Consequent upon order No. 60 of the Canada Food Board, published on the 5th inst. in the Canada Gazette, the use of sugar is greatly restricted and the manufacture of products characterized by their sweetness are to this extent handicapped.

Many requests to use saccharin have been received and the following concessions are made for the period under which order No. 60 will be enforced:

Saccharin may be used as a sweetener to make up the deficiency of sugar (regarded as a sweetener only), provided that declaration of the presence of saccharin is made.

The value of pure saccharin (saccharin puriss) in relation to sugar may be taken as 500 to 1; in other words 1 lb. saccharin is equal in sweetness to 500 lbs. of sugar. Commercial saccharin is usually standardized to a strength of 300; that is, 1 lb. of commercial saccharin is equal in sweetness to 300 lbs. of sugar. Since some manufacturers standardize saccharine to other strengths, it is necessary for the user to acquaint himself with the exact nature of the article employed by him.

Saccharin must not be employed without declaration of its presence; this is necessary for two reasons: in the first place saccharin possesses no food value and the nutritive value of an article in which saccharin replaces sugar is lessened to the extent to which sugar is absent; in the second place while saccharin is regarded as practically harmless in the case of healthy persons and in quantities not exceeding 0.3 gram per day (4.65 grains) it is certain that many individuals cannot use saccharin without injury; for this reason the presence of saccharin must be noted, so that physicians may be properly advised.

SCIENTIFIC OIL RECOVERY

By urging the cementing of oil wells in the North Cuching field of Oklahoma, in order to keep out the detrimental flow of water, experts of the Bureau of Mines, Department of the Interior, Washington, U.S.A., have succeeded in increasing the production of oil from fifty wells more than 2,000 barrels a day.

Aside from the commendable saving of 2,000 barrels of oil each day for war uses, this lesson in practical conservation will add $4,500 a day to the operators' gross income, and if the increased oil yield continues for one year, a not over-sanguine expectation, there will be an addition of more than three-quarters of a million barrels of oil for war purposes, and $1,640,000 more in the pockets of the operators.

It happens that the crude oil from Oklahoma contains much gasoline. An increase of 2,000 barrels of crude oil a day means 500 barrels of gasoline a day or more than 7,500,000 gallons in a year's time. This saving alone, from this restricted field in Oklahoma, is sufficient to drive every automobile in the United States an average of twenty miles, and there are five and a half million automobiles in the country.

CANADA'S PULP AND PAPER INDUSTRY

Dr. J. S. Bates, of the Forest Products Laboratories, in a recent article on the expansion of the pulp and paper industry of Canada, states as his opinion that Canada may be destined to become the leading country in the world in the manufacture of pulp and paper products from wood; this largely due to our water-powers and suitable tree species. Canada has a total now of about 90 pulp and paper mills, export figures for 1916 showing that pulpwood, wood pulp and paper have increased to nearly half of the total export value (which is approximated at $100,000,000) of all forest products, with the exception of a small proportion of specially manufactured articles.

Spruce and balsam fir are the most important of the softwoods for paper-making, while hemlock, jack pine, tamarack and other conifers are coming into more extensive use.

The Place of the University in Chemical War Work

By E. W. Washburn, Vice-Chairman, Division of Chemistryand Chemical Technology, National Research Council of the United States

In normal peace times, so far as chemistry is concerned, the university has two main functions, first, the training of chemists, and second, the prosecution of research in pure and applied chemistry. In war times these still remain the principal functions of the university, but as has happened in so many other cases, these two functions must be modified to accord with war needs, and it is on the subject of what these modifications should be that I wish to speak to you this morning.

The Training of Chemists

A few weeks ago the War Department's Committee on Education and Special Training requested the National Research Council to make an analysis of the Government's needs for chemists, and to make recommendations covering the steps which should be taken to provide as far as possible to supply these needs. In order to obtain the necessary data a questionnaire was sent to all Government agencies employing chemists, asking them to state the number of chemists, kind of training (i.e., organic, metallurgical, etc.) desired, the increase in each of these classes of chemists which they estimated would be required during the coming year, and any changes in educational methods which they thought desirable in order properly to meet their needs.

From the answers received to this questionnaire the Research Council was able to determine approximately what the needs of the Government are with respect to the different kinds of chemists required. As to future requirements, the data collected indicate that something over 2,000 chemists will be needed by the Government during the next year in addition to the numbers now in service. These figures take no account of industrial requirements, but it is safe to say that the additional chemists required for necessary war industries will at least equal the number of that something over 4,000 additional chemists will be needed for necessary war work during the coming year. This number is considerably in excess of the normal output of the colleges, and we cannot hope to provide all of the chemists called for. The problem is, therefore, to make provision for training, as quickly as possible, the maximum number of chemists which the educational facilities of the country can take care of.

The source of supply of the additional chemists required by the Government and by the war industries will for the immediate future be those students in the Students' Army Training Corps who are preparing themselves for Chemical Warfare Service. While provision can be made in training camps for training the rank and file of certain other branches of the Army, this is not true in the case of Chemical Warfare Service. Most of the men in this service must be trained as chemists and this training can be given to them only at the colleges and universities.

The analysis of the Government requirements for chemists indicates that, in general, the chemists needed may, for purposes of consideration, be divided into three classes as follows:

1. Analytical chemists: that is, men who have received sufficient training in chemistry to enable them to carry out routine analytical work under direction.

2. Chemists with a good general training in all of the fundamental branches of the subject, and with some degree of further instruction in one of the following: (a) physical chemistry, including electro-chemistry and metallography; (b) organic chemistry, including the chemistry of explosives; (c) food and sanitary chemistry; (d) physiological chemistry; (e) chemical engineering, including ceramic engineering, petroleum, textile, rubber, leather, etc., technology, and metallurgy.

3. Chemists qualified to carry on research work intelligently in some one of the fields listed under Class 2.

Approximately one-third of the total number of chemists required will be in Class 1, and will be employed in routine analytical and control work.

The National Research Council, at the request of the War Department, has drawn up a set of recommendations embodying a three years' curriculum in chemistry and a three years' curriculum in chemical engineering, each curriculum being based upon a year composed of 4 terms of 12 weeks each. Under this scheme the first group of chemists required can be trained in one year, the second group in two years, and the third group in three years.

The following statements outline the general plan under which the Students' Army Training Corps will operate under the changed conditions produced by the revision of the Selective Service Law:

1. All young men who are planning to go to school this fall should carry out their plans and do so. Each should go to the college of his choice, matriculate, and enter as a regular student. He will, of course, also register with his local board on the registration day set by the President. As soon as possible after registration day, probably on or about October 1st, opportunity will be given for all the regularly-enrolled students to be inducted into the Students' Army Training Corps at the schools where they are in attendance. Thus the Corps will be organized by voluntary induction under the Selective Service Act, instead of by enlistment as previously contemplated.

The student, by voluntary induction, becomes a soldier in the United States Army, uniformed, subject to military discipline, and with the pay of a private. They will simultaneously be placed on full active duty, and contracts will be made as soon as possible with the colleges for the housing, subsistence, and instruction of the student soldiers.

2. Officers, uniforms, rifles, and such other equipment as may be available will be furnished by the War Department, as previously announced.

3. The student-soldiers will be given military instruction under officers of the Army and will be kept under observation and test to determine their qualification as officer-candidates, and technical experts such as engineers, chemists, and doctors. After a certain period, the men will be selected according to their performance, and assigned to military duty in one of the following ways:

(a) He may be transferred to a central officers' training camp.

(b) He may be transferred to a non-commissioned officers' training school.

(c) He may be assigned to the school where he is enrolled for further intensive work in a specified line for a limited specified time.

(d) He may be assigned to the vocational training section of the corps for technician training of military value.

(e) He may be transferred to a cantonment for duty with troops as a private.

4. Similar sorting and reassignment of the men will be made at periodical intervals, as the requirements of the service demand. It cannot now be definitely stated how long a particular student will remain at college. This will depend on the requirements of the mobilization and the age group to which he belongs. In order to keep the unit at adequate strength, men will be admitted from secondary schools or transferred from Depot Brigades as the need may require.

Students will ordinarily not be permitted to remain on duty, in the college units after the majority of their fellow citizens of like age have been called to military service at camp. Exception to this rule will be made, as the needs of the service require it,

in the case of technical and scientific students, who will be assigned for longer periods for intensive study in specialized fields.

5. No units of the Students' Army Training Corps will, for the present, be established at secondary schools, but it is hoped to provide at an early date for the extension of military instruction in such schools. The secondary schools are urged to intensify their instruction so that young men 17 and 18 years old may be qualified to enter college as promptly as possible.

6. There will be both a collegiate section and vocational section of the Students' Army Training Corps. Young men of draft age of grammar school education will be given opportunity to enter the vocational section of the Corps. At present about 27,500 men are called for this section each month. Application for voluntary induction into the vocational section should be made to the Local Board and an effort will be made to accommodate as many as possible of those who volunteer for this training.

Men in the vocational section will be rated and tested by the standard Army methods and those who are found to possess the requisite qualifications may be assigned for further training in the collegiate section.

7. In view of the comparatively short time during which most of the student-soldiers will remain in college and the exacting military duties awaiting them, academic instruction must necessarily be modified along lines of direct military value. The War Department will prescribe or suggest such modifications. The schedule of purely military instruction will not preclude effective academic work. It will vary to some extent in accordance with the type of academic instruction, e.g., will be less in a medical school than in a college of liberal arts.

8. The primary purpose of the Students' Army Training Corps is to utilize the executive and teaching personnel and the physical equipment of the colleges to assist in the training of our new armies. This imposes great responsibilities on the colleges and at the same time creates an exceptional opportunity for service. The colleges are asked to devote the whole energy and educational power of the institution to the phases and lines of training desired by the Government. The problem is a new one and calls for inventiveness and adaptability as well as that spirit of co-operation which the colleges have already so abundantly shown.

Under the new regulations any properly equipped high school graduate may now enter the college of his choice. He will be provided with quarters, mess, light, heat, equipment, and free instruction, and will be paid $30 a month. Throughout the time he is in college he will be under strict military discipline. At the end of every 12 weeks his record will be scrutinized and if his work is in any way unsatisfactory, he will be immediately taken out of college and assigned elsewhere, probably in many cases to one of the cantonments. Former college students will find college life an entirely new proposition. Doubtless many of you have seen on the walls of fraternity houses such mottoes as the following: "Never permit your studies to interfere with your regular college work." The student who follows any such motto as this under the new conditions will find himself neatly and with great despatch removed from his academic surroundings. Such customs as petitioning the Faculty for another trial, or for a special examination, and all other hallowed customs of this kind will pass out of existence. The student either makes good or he doesn't; he either passes or he fails. The lame duck species of college student is about to become extinct. The men who remain in college after the first three or four terms will be only those students who have displayed exceptional ability for some special line of training.

The statements received from the various Government agencies concerning desirable modifications in the training of chemists may be of some interest. As might be expected, all agencies of the Government emphasized the need of more thorough training in the fundamental branches of the science, that is, in inorganic, organic, and physical chemistry. In addition, certain special subjects were mentioned by a number of different Government agencies. For example, the various arsenals emphasized the need of more men well trained in metallurgy and metallography. The Navy Department pointed out that many of their men apparently had received no definite instruction in methods of using chemical literature or in proper methods for drawing up specifications. As might be expected, many branches of the Government also pointed out the need of special courses in the chemistry of explosives. Additional numbers of (1) pharmaceutical chemists were called for by the Bureau of Chemistry and by Chemical Warfare Service; (2) physiological chemists by the Surgeon General's Office and by Chemical Warfare Service; (3) food and sanitary chemists by the Surgeon General's Office and by the Bureau of Chemistry; (4) ceramic chemists by the Bureau of Standards and by the U. S. Fuel Administration.

Research on War Problems

Under normal conditions every research laboratory is confronted with more problems than it can take care of. Since the war the personnel of many of the Government laboratories has been increased many fold, and it might be thought that with this greatly increased personnel these laboratories would be in a position to care for all of the problems which now exist. Such, however, is not the case. It is true that the Government now provides, as it must necessarily provide, for the investigation of all the larger and more urgent problems with which it is confronted, but nevertheless, most of the Government laboratories are overcrowded with work, and have trouble in securing certain classes of equipment and the services of sufficient numbers of adequately trained men. It is true that more men might be obtained if laboratory space could be provided for them, but such additional numbers could only be secured by further depletion of the staffs of educational institutions, and such action would result in completely shutting off the supply of chemists for the future.

Although the Government is providing in its own laboratories and under its own direct control for the investigation of the important research problems connected with the prosecution of the war, there are many important problems still unsolved or only partially solved. For example, many of the problems which the Government has had to solve have been problems connected with the production of some new material or the development of some new process to fill an urgent need. As soon as a material or process has been obtained which meets this need more or less satisfactorily the laboratory in charge has then found it necessary to transfer its attention to some other urgent problem. As a result there are many processes and materials which have received only that amount of study which was necessary to insure their operating sufficiently well to accomplish the desired end. In other words, output of *something which would do* has been the sole purpose and result of the research work. It thus happens that in many cases there has been no opportunity to ascertain just why certain things tried have worked, or why certain others have failed; or just why certain conditions seem to be more favorable than others; or just what occurs at this or that stage of the process; or why some other method might not give a higher yield or a better quality of material than the one which is actually employed because it has been found to work; or whether certain cheaper or better raw materials might not be available; or just what is the relation between factor A and factor B which enter into some part of the operation, etc., etc. There are indeed many auxiliary problems of this character which have arisen in connection with the research work, and which are worthy of the careful scientific study which they can receive only in some laboratory not working under the high pressure which prevails in many of the Government laboratories.

---

*Part of an address delivered at the 56th Meeting of the American Chemical Society, Cleveland, Sept. 10, 1918

RELATION OF RESEARCH TO INDUSTRY

(Continued from October Issue.)

Dr. Mackay—Mr. Chairman, the opinions that you have asked from the different members of the committee is my apology for including mine. The object in view is, of course, to co-ordinate as perfectly as possible the industries with research. Now, it seems to me that this is not going to be initiated by any one agency, but by the operation of all the proposals that have been brought forward to-night. You must, it seems to me, develop a central bureau. The fact that we need it in Canada may be proved by the fact that other countries have found it so, even where research is more fully developed than is ours. It is not, I think, a serious objection to the beginning of such a central bureau of research that we cannot bring it fully developed into exisence as has been pointed out. These things have had to start from small beginnings. Now, no doubt, this central bureau will have to begin in a small way, but it must begin if it is ever to come into existence at all. On the other hand, the University represents the cradle of research, and it seems to me that they have a double function to perform. On the one hand, they have to train researchers; on the other hand, I believe it is their function in part to bring the value of research home to the manufacturers in the particular locality where the universities are located. That would be of benefit to the universities themselves. It has always been found to be so, and it is, of course, of benefit to the manufacturers to obtain the solution of a problem in which the whole industry is interested.

I have great sympathy with the idea put forward by Dr. McGill, that the Chairman of the Council write a book. That would, I think, have an impressionable value, but the effect of the book would be greatly enhanced and made more permanent by the development also of other features of research suggested, and the development of the guilds will in the end, I believe, be found to be one of the powerful factors in bringing manufacturers to a realization of the benefits of research. To interest the manufacturers you must get them to put some money into the scheme. Until you induce them to do that, you are merely dabbling with the solution. It seems to me that these are the three important factors, Central Research Bureau, the Guilds and Universities, which have an essential function to perform, without which result hoped for can never be attained. It seems to me, we can safely have in the hands of the Council the best plan to bring about due co-ordination of the parts which these different portions of the organization should play and the emphasis that should be laid upon each of them.

Dr. Macallum—When I spoke earlier, my desire was to be as brief as possible, but I omitted a great many things that I might have enlarged upon.

I wish now to refer to them in more detail. We have thought over all these questions. We have been doing that for over nine months. Again and again has the Council had these questions come up. There is not one single aspect of them that has not been touched upon and emphasized many times. We have been slow in reaching conclusions, because we recognized the complexity of the problems. We are, however, forced to action by this consideration. When this war closes, the industries in Canada will be in a precarious state. The Dominion itself will face a serious situation. One of the Ministers has stated to me in conversation, that he will not be surprised if the national debt reaches three billion dollars at the end of the war. That will mean $150,000,000 annually in interest, and an annual budget of $400,000,000 to $450,000,000. How is the country going to bear that? How are the industries going to meet it? We cannot just stand still and forever debate this question. We have got to prepare immediately to meet this extremely urgent situation, and to-day, therefore, one of the most serious questions that the country has got to consider presents itself to you in connection with industrial research. What are you going to do for the industries? How are you going to enable them to bear the load of debt they, in the end, must assume?

We have not forgotten the universities. We have not overlooked them as the nurseries of research. I believe the universities must train those who are to undertake research and initiate them in its earlier stages. The central research institute we propose, is not to train men for research. That evidently is done at the Bureau of Standards in Washington. I do not think that is justifiable. We have given the most careful attention to the question of founding a Research Institute. I have visited Washington three times since I assumed my present position, in order to get the benefit of the experience of the heads of the Scientific Departments there, so far as it would help me to rearch a decision in the kind of organization for research that would serve our needs. The Council has also been there for the same object. It had two sessions in Washington, four hours each, discussing this matter with the assembled representatives of the scientific bureaus, the great majority of whom took part in the discussion. The Council, as a result, recognized the defects of the organizations there which we must avoid when we found a scientific bureau or research institute in Canada, such as the one proposed. What impressed itself most upon me was the fact that there was no system at Washington. Everything had been allowed to grow without co-ordination. There are four bureaus which encroach more or less on each others' functions and thus waste effort and money. It is certain that we should not proceed in that way. In founding a central research institute we should so determine its functions that it will without much change answer our needs for the next half century.

It has been urged that the functions of this research institute should be conferred on our universities. This would involve us in difficulties. We cannot afford to do anything that will injure the universities. We are interested in their success. We must, however, maintain our own independence, and avoid compromising relations. We must also avoid favoritism or the appearance of it. So far we have maintained a correct attitude. We shall have our difficulties and particularly with regard to the standards they observe. There are, in all, eighteen of them. They are not equally efficient. How shall we assist them and bring the better equipped to recognize our standards? We would have to subsidize them in order that they might do the work of a research institute. Our financial resources are limited and in consequence a selection of a few for aid would have to be made. That would involve us in political difficulties which would spell failure to such a project. All the financial aid that the Government could give for research would be best expended in the foundation and maintenance of an institute independent of the universities. We can, of course, aid the universities in an indirect way and we have already done so to a certain extent. We have instituted studentships and fellowships, twenty-five in number. We may ultimately provide for as many as 100. This would stimulate the universities to train the students for these and thus enhance their own efficiency. The difficulty now is, we cannot get the students required for those already provided. Not more than one-third of these were filled last session. We shall, however, continue these studentships and fellowships which will, whenever possible, be used at Canadian universities.

We can aid the universities indirectly in another way. We give grants to aid researches and we will continue to do so after the research institute is founded. Through these grants the scientific members of the staff of our universities may succeed in prosecuting researches, which otherwise they would be unable to undertake. This would introduce the spirit of emulation and thus the universities would benefit.

We have got to provide for the urgent needs of the industries, and the standardization in this country of all our physical material. We must try to make the most of the industries by enabling them to help themselves, We can do that by encouraging them to form guilds in which will be pooled their money for

research, to be all used to the utmost advantage. In Great Britain, there are being formed such organizations called associations which will, if necessary, receive grants from the Government for researches in the industrial problems in which they are concerned. These associations will command large funds and in the majority of cases be able to institute and maintain their own laboratories. The Canadian industries have smaller financial resources and their guilds could not maintain their own laboratories. It will be necessary for the Government to furnish them with free laboratory accommodation and for this purpose it is recommended that laboratories for the guilds should be erected in association with the research institute. In such laboratories the guilds could place their researchers who could be supervised in their work by the staff of the institute. Such researchers would be in demand and their training for such positions would be a great opportunity for service on the part of the universities.

Where the research institute will be located is undecided as yet. It may eventually be established in Ottawa, but Montreal or Toronto, at this moment, appears as suitable a location for it as Ottawa.

I have briefly put the point of view of the Council before you, but you will find it dealt with fully, in my first report as chairman. This will appear in print in a few weeks, and copies of it will be accessible to you. In the section of that report headed, "Research in Canada, How to Stimulate its Advancement," I have discussed the question of guilds and the establishment of the research institute, on which the Council, with the exception of one member, is a unit.

Dr. Goodwin—I am very grateful to Dr. Macallum. I am sure that we all are for his elaboration into more details of his ideas, the ideas of the Council which he represents, particularly in connection with the university. He just brings out the fact, I think, that we are all of pretty much one mind on this subject, and that it is only a question of working out the details so as to produce a well balanced scheme. That was my only object in speaking as I did before, and I feel that that object has been somewhat attained. I was afraid that the proposed institute would be, as it were, an intermediary between the industries and the universities, and that the universities would suffer from a lack of direct connection. There is nothing like being directly connected, you know, but I see that Dr. Macallum in his outline now, has made it quite clear that it is not intended that the universities are to be fully utilized, and in such a way as to keep them in close touch with the industries. I am exceedingly grateful to Dr. Macallum for having brought that point up.

Dr. Ruttan—It is clearly unnecessary for me to add anything to what has been said, but I can only say that I can assure all the members of the Chemistry Committee that everything that can possibly be done by the Advisory Council to aid research in the universities will be done. There is not a single point that has been suggested by those on the Council and those who are connected with it, with regard to assistance in the universities, that has not met with the most cordial response and been carried out in every possible way, so that those who are afraid that the central institute would interfere with the universities' work, I think, have very little grounds for their fears.

We are now near the close of the evening, and I would just ask Dr. Johnson to touch on one point which he spoke to me about and which, I understand, has been already partly worked out by the Department of Mines, and that is, the importance of obtaining fuller information regarding the chemical industries of Canada. The point is an extremely interesting one, and I would like very much to have him set it before us before we break up.

Dr. Johnson—I have only a very few words to say, and those are rather in the nature of a suggestion and perhaps an appeal.

In listening to the remarks which have been made this afternoon and evening, one thing has struck me throughout, and that was my ignorance, particularly in regard to the chemical industries which we have in Canada. It seems to me that if we had something in the nature of a concise inventory of our chemical industries, their locations, raw materials that they use, their products and their by-products, an outline in the way, perhaps, of what may be called a chemical map of Canada might be constructed, and which, to me, would be exceedingly useful fundamentally to go upon. Possibly there are others in similar positions.

Dr. Parker—Might I support as strongly as possible, Dr. Johnson's suggestion? I know that for my part in Western Canada, I feel very much out of touch with industrial matters, especially in Eastern Canada. We know nothing, practically, of what has been going on here. One hears of certain industries being conducted occasionally, but one does not really know what is going on, and from one point of view, for example, I feel that it would be a great advantage to know more.

Students often ask what possibilities are there in chemical industries in Canada. There are very few chemical industries in Manitoba. One hesitates to recommend students to go into work of which one has so little information. I think a great benefit would arise from carrying out Dr. Johnson's suggestion.

Dr. Ruttan—I might say that this matter has come up before us in the Council, and I recommended certain questions be put in the questionnaires sent out by the Department of Statistics. We got a reply that as soon as the questionnaires were in, that Department of Statistics would send us an extract from this questionnaire which would give us in one place a list of the various chemical industries and statement regarding same, such as referred to by Dr. Johnson, and I sincerely hope that this movement will not be a very slow one, and that we may get results of these questionnaires in a very short time. In the meantime, I understand that some other steps have been taken in the Department of Mines to obtain a list of industries which are more or less chemical.

Dr. Bates—I have had this thought in mind for years, and the Department of Mines went ahead with their idea a year or more ago. Dr. Wilson, Mines Branch, has conducted this investigation, and I think has personally investigated practically all the chemical industries of Canada, obtaining an outline of information which Dr. Johnson mentions, I presume his report is in the hands of the government printer. Therefore it will be published in a year or two, perhaps before we meet next.

Professor Bain—I might say there is something that perhaps Dr. Johnson and Prof. Parker do not know. The Canadian Branch of the Society of Chemical Industry, in 1912, made a chemical census of this country and got up a pamphlet which is fairly up to date. That pamphlet may be got without any difficulty if you ask Mr. Alfred Burton, Imperial Munitions Board, Ottawa.

Mr. Wardleworth—The point is this, that the compilation of the chemical industries of Canada was, I believe, handed over to the Council for Industrial Research with the idea that the Council would continue the work and keep up the record.

Dr. Ruttan—I am afraid we will now have to bring the meeting to a close. I hope that this is only the first of a large number of meetings of those of us who are associated with the Advisory Council in connection with chemistry, and I am sure these meetings will help forward chemical research, and I feel that a great deal of good has been done. I hope you will agree with me that we have all been stimulated in finding out what has been going on in the different parts of the Dominion and the various researches that have been undertaken, and the interchange of views on the debated questions have helped to clear the air. I would like you all to remember that we are only too glad to assist researches, and if any of you know of a good researcher, a reliable man who is engaged in research, and able to undertake something that is going to add to our knowledge of chemistry or science in its application to industries, by all means have him apply to the Advisory Council for an assisted research. I sincerely hope we will get many more applicants this year than last.

NOTES FROM NEW YORK

Correspondence to The Canadian Chemical Journal, by F. M. Turner, Jr.

October 31st, 1918.

Two large sulphuric acid plants are being built by the U.S. Government. One of these is situated at Emporium, Pa., and the other at Mount Union, Pa. The two plants will cost about $3,000,000. Both of these plants will be adjacent to existing plants of the Aetna Explosives Company. The design of the plants has been prepared by the Construction Department of the Ordnance Department and the contract has been let to the Leonard Construction Company.

A new plant for the manufacture of sodium silicate is being built by the Philadelphia Quartz Company at Rahway, N.J. The site comprises over 30 acres and is conveniently situated on the Pennsylvania Railroad. This plant will cost over $1,000,-000.

Benzol for the government will be produced at a new by-product coke plant to be operated in connection with the blast furnace and mill of the Phillips Sheet & Plate Co., Weirton, W. Va.

One of the most disastrous explosions ever experienced in America occurred when the shell loading plant of the T. A. Gillespie Company, Morgan, N.J. was destroyed. The explosion was caused by tri-nitro-toluol. The loss is estimated at $12,000,-000. Over 100 persons were killed and very many more injured. Great distress was occasioned by the necessity of inhanitants of many nearby towns evacuating their homes. The main magazine on the premises contained 80,000 lbs. of the explosive and fortunately escaped safely.

The explosions could be distinctly felt in New York City and at other points within a radius of more than thirty miles. Various theories have been advanced as to the cause, but it will probably remain a mystery as all those concerned are dead.

I. F. Stone, formerly President of the National Aniline & Chemical Co., Inc., has resigned from the active management of the organization, still retaining his membership in the Board of Directors of the Company.

In connection with the investigations into chemical plants formerly owned by German interests in this country some very interesting facts about German conspiracies have come to light, showing that the Hins were active even before the United States entered the war. An interesting account of disclosures recently made by the Alien Property Custodian is given in a recent number of the "Oil, Paint & Drug Reporter," from which we quote the following extracts:—

"The story of the Chemical Exchange Association was unearthed by Francis P. Garvan, director of the Bureau of Investigation, in his investigation of the German-owned chemical companies in this country which have recently been tkaen over by the Alien Property Custodian. He found that Dr. Albert, in conjunction with Count Von Bernstorff, arranged with Dr. Hugo Schweitzer, a naturalized American and a chemist of the Bayer Company, to prepare and carry out plans which would prevent the shipment of carbolic acid to England, France and Italy, by converting it into salicylates, salol, formaldehyde and aspirin. This plan also provided for keeping away from American munition manufacturers the supply of carbolic acid available at that time, so that they would be hampered and hindered in the manufacture of high explosives for the allies."

The Heyden Chemical Works of 135 William Street,New York, and the Bayer Company, of 117 Hudson Street, New York, were the two chemical concerns through which Dr. Schweitzer arrnged to carry out his plans. Both of these concerns are now in the hands of the Alien Property Custodian and are bein managed by 100 per cent Americans. The Heyden Company was owned by the Chemiske Fabrik von Heyden, Radeubul, Germany, and the Bayer Company was owned by Farbenfabriken vormals Friedrich Bayer & Co., of Elberfeld, Germany.

In 1915, when it became apparent that carbolic acid was a necessary ingredient in the manufacture of high explosives, Thomas A. Edison invented a synthetic carbolic acid, of which the American Oil and Supply Company, of Newark, became the selling agent. Comparatively little carbolic acid was purchasable at that time. Dr. Schweitzer immediately set out to control this supply, and one June 22nd, 1915, entered into a contract with the American Oil and Supply Company whereby this company agreed to ship 6,000 pounds of carbolic acid each working day from July 1st, 1915, to December 31st, 1915, and 4,000 pounds each working day from January 1st, 1916, to March 31st, 1916. at a price of $1,06 2/3 per pound cash from July 1st to December 1st, 1915, and $1.00 per pound cash for all succeeding deliveries. This price was nearly double the usual market price.

On June 30th, 1915, Dr. Schweitzer entered into a contract with the Heyden Chemical Works, of which George Simon, a German subject was the manager, whereby Schweitzer agreed to deliver all of the carbolic acid received from the American Oil and Supply Company to the Heyden Works, at Garfield, N.J., the Heyden Works, at Garfield, N.J., the Heyden Company agreeing to increase its facilities and convert the carbolic acid into salicylic acid. Schweitzer was given ann optio whereby he might have the carbolic acid also converted into sodium salicylate, methyl sallicylate, and salol.

To obviate doing business in his own name, Schweitzer organized what was called the Chemical Exchange Association on June 30th, th- day on which he made his contract with the Heyden Chemical Works.

Every effort was made by Schweitzer and Kny to keep their contract secret and to prevent the American people from knowing that Dr. Albert and the German Government were behind this contract.

Dr. Schweitzer died in December, 1917. Amoung his effects Mr. Garvan discovered the following statement, which shows how thoroughly he was in touch with the carbolic acid situation in this country at that time:—

"Explanation of the attached agreements.

"The following firms were manufacturing carbolic acid in the United States:—

"The Semet-Solvay Company, Rochester, N.Y.

"The DuPont de Namours Powder Company, Wilmington, Del.

"Thomas A. Edison, Inc., Silver Lake, N.J., and

"Merk & Co., Rahway, N.J.

"The Semet-Solvay Company and the DuPont p-ople do not "sell carbolic acid to anybody, but convert it into picric acid and "sell it to the Allies.

"Merck & Co. sell their carbolic acid for pharmaceutical "purposes exclusively and exact an agreement from the buyers "that the product should not be used for manufacturing ex-"plosives.

"Edison Company has made an agreement with brokers who "were to furnish picric acid to the Allies. The carbolic acid "which they purchased from Edison was to be converted by "powder manufacturers, among them the Trojan Company, "into picric acid.

"It occurred to me that through my connectlns with Mr. "Hoffman, of the American Oil and Supply Company, I might "be able to divert the carbolic acid of Edison from these brokers "and thus prevent the conversion of the same into picric acid. "This would be so much more important, as Edison is the only "one in the United States who for the next three or four years "has spot carbolic acid for sale.

"As a matter of fact I thus succeeded in getting hold of 6,000 "pounds of carbolic acid per day, which is equivalent to 18,000 "pounds of picric acid per day. For the purchase of this quantity "I made agreement marked 'A' with the American Oil and Supply "Company.

"In view of the fact that as stated above this carbolic acid "was for at least three or four months the only acid available "in the market, it would have been good policy to buy the "product even at the high price paid, which however, is about "35 cents per pound lower than the acid which our firm bought "on contract.

"I then conceived the idea of having this carbolic acid con- "verted into salicylic acid, salicylate of soda, salol and artificial "oil of wintergreen. On these products there is an embargo in "all countries at war. The prices are very high and the salicylic "acid which is made out of the above carbolic acid would, in "fact, for the next three or four months, be the only free salicylic "acid to be bought without any restrictions. On account of "the high prices for these products there is a possibility of not "losing money in the venture; in fact, profits might be made pro- "vided that England's shipping blockade is maintained and "provided that the war does not end within the time limit of "the agreement."

In the latter part of 1916, Dr. Schweitzer and Richard Kny gave a dinner at the Hotel Astor in honor of Dr. Albert and in celebration of the success of the Chemical Exchange. Dr. Albert in response to the toast stated that he felt he had rendered valuable aid to the German Empire and had saved many German lives by preventing the allies from obtaining carbolic acid and by converting it into harmless pharmaceutical products.

The German propagandists fully believed that the war would end in the latter part of 1915, and that Germany would be victorious. Consequently, they laid their plans accordingly.

At a meeting of the American Chemical Society at the Chemists Club, New York City, a fine portrait of Charles M. Hall, inventor of the Hall Process for producing aluminium, was unveiled. Dr. E. B. Pickrell of the Bureau of Foreign and Domestic Commerce spoke on the subject of the Chemical Census.

At the first meeting of the Society of Chemical Industry for this season, held at the Chemists' Club, New York City, Friday, October 25th, an address was given by Major Dudley of the British Gas Service on the subject of "Gas Warfare." There was a large attendance including many members of the American Chemical Warfare Service and British and French officers. Major Dudley explained the development of gas warfare both by the allies and the enemy since its first introduction. He explained the chemical nature of the various gases used and also the forms of shells, bombs and grenades in use at the front. Samples of English, French, American, German and other gas masks were on view. The address was followed by moving pictures showing gas attacks and other features of warfare on the front. These pictures were official pictures taken and loaned by the British Government, and were very interesting.

ORGANIZATION FOR EXPORT TRADE

A special committee has been formed by the Canadian Manufcturers Association to investigate and promote the foreign trade of Canada after the war. The need of maintaining Canadian industries and the export trade of Canada in raw materials during the reconstructive period after the war has been strongly impressed on the industrial and commercial bodies by Senator Frederic Nicholls on many occasions, and it was fitting that he should be appointed chairman of this committee, which will co-operate with the Industrial Reconstruction Association at the head of which is Sir John Willison. The labor bodies are also invited to participate. On this committee is Mr. D. D. McTavish, of the Canada Carbide Co., whose long and intimate contact with varied industries, including the chemical manufactures, will make his services very valuable. A deputation comprising Senator Nicholls, Messrs. McTavish, Parsons, and Major Auther waited on the Premier and cabinet a few days ago to make suggestions for the after-war trade of Canada meet the other Dominions and foreign countries.

FRED W. PAYNE

Having for his lifework the advancement of commerce, industry and social welfare work, Mr. Fred W. Payne, of the management of the National Exposition of Chemical Industries, has had a varied experience. It was the late president of the United States, William McKinley, who said: "Expositions are the timekeepers of progress," and Mr. Payne took the martyred president's expression as his keynote. He identified himself in the management of no less than sixty expositions of various sorts held in many

MR. FRED W. PAYNE
Manager National Exposition of Chemical Industries.

sections of the United States, all of which had to do with the advancement of industry and betterment of welfare conditions. That his efforts are appreciated by those who participated in expositions held under his management is best attested by the fact that his advice and services are always sought in the promotion of important affairs relating to industries.

Mr. Payne's experience in exhibition work and Mr. Roth's knowledge of the chemical industries, made an ideal combination when they were appointed joint managers of the series of chemical exhibitions. Mr. Payne's tact and good nature are proof against the assaults of the fault finder, and it is to be hoped that the chemical industries will long have the benefit of his skill and industry.

THE WAR BOARD TAKES CONTROL OF STEEL

By a recent Order-in-Council the War Trade Board is given extensive powers in supervising and directing the production and manufacture of steel in Canada, the object being to co-ordinate the producing power so as to insure the maximum of efficiency and production. This Order, however, will not affect the financial or general management of the steel companies. The shortage of steel in the United States at the present time, due to the tremendous demand for war purposes, has made it imperative that the greatest possible economy in production should be exercised, and that the different producers should co-operate among themselves and with the War Trade Board, which has authority to enforce such orders as it may deem necessary, assigning to each plant a certain kind of work. The demands upon the American steel industry has made it incumbent upon Canada to provide supplies for basic as well as war industries.

PERSONALS

Capt. R. T. Dickson, a graduate in arts in Queen's University, has been appointed chief plant pathologist of the British Army, as a result of good work carried out in the scientific application of sprays to large areas of potatoes. Previous to entering the Army, Capt. Dickson was an instructor in plant pathology in Cornell University.

Capt. H. P. Armes, Assistant Professor of Chemistry, Manitoba University, who was severely wounded and who has lost one leg in active service, is home again and has resumed his duties on the staff of the Chemical Department of the above university.

Word has been received that Lieut. R. A. Cunningham, Lecturer in Chemistry at the Manitoba Agricultural College, was killed in action about October 1st.

Mr. W. Morgan, B.A., Toronto, formerly with the Atlantic Sugar Co., St. John, N.B., has been appointed assistant in chemistry at the University of Toronto.

We regret to note the very sudden death of Mr. Ernest Cox Durden, A.R.S.M., of the Royal Mint, Ottawa. After a brief illness from pneumonia, Mr. Durden passed away on Oct. 11th. He was the son of Mr. and Mrs. W. J. Durden, of "Wynstay," Dorchester, Dorset, England. His education was received at the Dorchester Grammar School and the Royal School of Mines, London. Although only 33 years of age, he had filled the position of Assistant Assayer at the Royal Mint for the last five years in a most capable manner. During this short period in Canada both he and his wife had made many warm friends among the members of the chemical profession attached to the Government staff at Ottawa.

Mr. Richard Hamer, M.A., of West Toronto, has been awarded a Research Scholarship valued at $750 by the Canadian Government Industrial and Scientific Research Council. Mr. Hamer has just completed some research work on the investigation of collodial solutions of rubber by means of the ultramicroscope and vicosity measurements at the Physics Department of the University of Toronto.

Mr. Wm. W. Davies, of the Electro-Metals, Ltd., Welland, has been allowed exemption from military service until he has ceased to be employed as a chemist in the manufacture of ferrosilicon and carbon electrodes, but not longer than Dec. 31st of the present year.

Mr. T. Ernest Godson, K.C., Mining Commissioner for the Province of Ontario, and Mr. T. F. Sutherland, Chief Provincial Inspector of Mines, are making a tour through British Columbia in the interests of the mining industry of that Province.

Dr. F. W. Farrier, of the Munitions Resources Commission of Canada, and Mr. R. Graham, assistant professor of mineralogy at McGill University, are inspecting mica deposits in the Cascade Range, British Columbia. They are accompanied by Wm. Schmock, who discovered the deposits and succeeded in interesting the Dominion Government in his find.

Mr. H. R. Van Wagener, of Denver, Col., has been appointed general manager of the Canada Copper Corporation and will make his headquarters at Copper Mountain, near Princeton, B.C., where the company's properties are being rapidly developed.

Mr. Sidney C. Ells, B.A., B.Sc., formerly technical engineer in the Roads Division of the Department of Mines, Ottawa, has gone overseas with the Engineers.

At the annual meeting of the American Peat Association in New York in September, Mr. B. F. Haanel, Chief Engineer, Division of Fuels, Department of Mines, Ottawa, was re-elected Vice-President. Mr. Haanel delivered an address on the subject of the utilization of peat which proved of such interest to the American Association that a committee was appointed to confer with him regarding the situation in the United States. The work of the Mines Department at Ottawa is in advance of anything else that has been done in America towards the utilization of peat, a fact which is not well known, and of which Canadians have a right to be proud.

A letter from Mr. R. T. Elworthy, B.Sc., gives the news that he is still with the Admiralty Inventions Board in London. Mr. Elworthy was formerly on the staff of the University of Toronto, and later with the Mines Branch, Ottawa.

A. van Anrep, Peat Expert of the Department of Mines, is at present in Nova Scotia investigating a deposit of peat.

Dr. H. V. Ellsworthy has just returned to Ottawa after a few weeks in the Cobalt district.

Miss Della M. Stewart, M.A., of Ottawa, has been re-elected Treasurer of Queen's University Alumnae. The annual meeting was held in Kingston last month.

The degree of Doctor of Agricultural Science has been conferred on Mr. J. H. Grisdale, Acting Deputy Minister of Agriculture and Director of Experimental Farms, by Laval University, Quebec. This degree was, on th same occasion, conferred on the Honorable J. A. Caron, Minister of Agriculture for Quebec; Reverend Father Michaud, President of the Agricultural Missionaries of Quebec; and Mr. A. T. Charron, Chief Chemist of the Department of Agriculture of the Province of Quebec and Director of the Provincial Laboratories.

Among the victims of the influenza epidemic last month was Melville A. Kemp, B.Sc. (University of Toronto), who was employed by the Imperial Munitions Board at Hamilton. His remains were brought for burial to Toronto, where his wife was ill from the same disease.

We regret to learn that Dr. H. L. Stewart, professor of Chemistry at Dalhousie College, Windsor, N.S., has sustained serious injuries by falling down an elevator shaft.

Mr. H. W. McCurdy and others, 350 Adelaide Street W., Toronto, have taken over the business of the Allied Chemical Co. which had started business last year in Saunders Ave. as makers of resorcin. The style of the business is now changed to the York Chemicals and the products of the factory are now nitrite of soda and litharge. Mr. W. A. Walton, formerly manager, moved to Montreal, joining the Phenarsenol Co.

THE MANITOBA CHEMICAL SOCIETY

This Society, which is in reality the only absolutely Canadian Chemical Society in existence, claiming a whole Province as its field, has already announced its Fall programme of meetings. Three meetings have been announced for the following dates: October 22nd, Nov. 19th, and Dec. 17th. At the first meeting Mr. Pugh, who is in charge of the Research Bureau of the T. Eaton Co., of Winnipeg, was to have given a paper on "The Microscopical Examination of Textiles," illustrated with microprojection views of slide mounts. This will also be the annual meeting, and election of officers will take place. The activities of this society are of more than ordinary significance, as it is not impossible to conceive that around some such nucleus as this, Canadian chemists may yet develop a means of organization more in sympathy with their needs than that which may be obtained by any other route. We wish the society a very prosperous and profitable season this coming winter.

For some time past the mining men of British Columbia have been trying to induce the Dominion Government to establish an analytical laboratory at some central mining point in the Province, and to this end Mr. M. S. Davys, of Laslo, B.C., has offered to furnish a building for such a mill. It is understood that the municiapl authorities of Kaslo would be willing to furnish the necessary electrical power.

The Olivine Mountain Syndicate, a Vancouver organization, has shipped a sample lot of two tons of ore containing platinum from Tulameen to Seattle, where it will be treated at the Faust concentration plant. Much active investigation is under way in this district, and the Department of Mines is co-operating.

INDUSTRIAL NEWS

The British Columbia Electro-Metals, Limited, has applied for change of name to "Tudhope Electro-Metals, Limited."

A law has recently been passed in France requiring all holders of platinum over 100 grammes to make a statement of the same before a prescribed time.

Under authority of an Order-in-Council the War Trade Board has passed a resolution prohibiting the use of structural steel, steel shapes, plate, bars or other form of steel, the value of which exceeds $2,000, in the erection of any structure whatsoever, except under permit issued by the War Trade Board.

The Canadian Official Record for October 15th states that the Fuel Controller for Canada has just concluded a general survey of the fuel consumption of various industries, including clay products, building stone, enamel and sanitary ware, and window glass. He reports that owing to war conditions there has been a large decrease in production in these industries, a number of plants having been unable to continue operation. In view of the absolute necessity for the continued production of these industries, the Fuel Controller has decided that it would be inadvisable to restrict the fuel supply of the plants remaining in operation. and devoted to the manufacture of absolutely essential products.

The Imperial Oil Company are at work on a $65,000 extension to their distributing plant at Lethbridge, Alta.

The Coniagas Mines, Limited, St. Catharines, Ont., intend erecting at Craigmont a plant for the treatment of feldspar tailings. The equipment will include crushing and power machinery, transmission material, etc.

The head office of the International Nickel Co., of Canada, Limited, has been established in the Harbour Commission Building at the foot of Bay Street, Toronto.

The Galena Signal Oil Co. are building a $60,000 two-storey concrete oil plant at their premises 134 Royce Ave., Toronto.

W. D. Beath & Son., Ltd., manufacturers of steel barrels, etc., are making a $6,500 brick addition to their plant at 20 Cooper Ave., Toronto.

The head offices of British Molybdenite, Limited, and of Wilberforce Molybdenite, Limited, have been installed at No. 34 Victoria St., Toronto.

The Canadian Industrial Alcohol Co., Ltd., has purchased the assets of the H. Corby Distillery Co., Ltd., and will carry on business as distillers and dealers in industrial alcohol, etc., at Corbyville, Belleville, Montreal, and elsewhere. The new company has been incorporated with a capital stock of $5,000,000, and its head office will be located in Montreal.

Canadian Wood Distillation Industries.—Although acetone may be prepared in Canada in large quantities from materials other than wood by various means such as fermentation of glucose directly or by way of the calcium carbide route, yet the older pre-war method is more than likely to survive. At the Longford Mill plant of the Standard Iron and Chemical Co. of Canada, acetone is produced from acetate of lime. It may be ordinarily considered a by-product of charcoal. Charcoal itself has found a rather unexpected market in Ontario and Quebec in connection with the new nickel refining plants that are being put under operation. In general the wood distillation industries have been greatly stimulated by war activities and now the above company alone produces over 1,300,000 gallons of wood alcohol annually in Canada. The demand for this product is assured both in Great Britain, southern markets and the United States, while the Canadian market itself is more than likely to increase. The Canadian West has developed the use of formaldehyde as a preventive for smut in grain, giving an outlet for very large amounts of this product. All signs would point to a most flourishing condition in this industry both at the present time and later on.

"The Northern Miner," in a recent issue, says that both the asbestos and chrome industries in the Province of Quebec are reported to have sold their output for the next six months. The extent of the orders is limited only by the capacity of the plants which, owing to war conditions, are unable to secure their full complement of labor

AFTERMATH OF TRENTON EXPLOSION

The explosion which occurred last month at the large plant of the British Explosives, Ltd., some two miles from Trenton, Ont., caused such damage that it is not probable that all portions of the plant will be rebuilt.

The situation in the products that were being manufactured is such that available plants in other places will more likely be expanded to meet the whole needs of America before this plant could be re-established. The T.N.T. and pyro-cotton plants were destroyed, leaving the acid plants in good shape. It is not likely that the T.N.T. plant will be rebuilt, while it is more than probable that some outlet for the acid plant will be re-established in the immediate vicinity. Serious as this loss was to our Canadian munitions industry, the net allied plants of America are now so large and are growing so rapidly that an explosion here and there has come to be taken as a small factor in limiting the total output.

BOOK REVIEWS

What Industry Owes to Chemical Science. R. B. Pilcher and F. Butler-Jones. Constable & Co., Ltd., London, W.C. 3s. net, 144 pp.

A very healthy and critical review of much that has been said during the last few years on the relation of science to education and industrial prosperity. The underlying feelings that actuate British industry are very well expressed. Achievements are set down in their bare simplicity and broad facts are left to make their own appeal. Each industry is taken in its turn and it is shown by examples how science has advanced methods and processes of production. The work covers a survey of many important industries, presented in such a manner that the substance is not altogether out of the depth nor beyond the interest of the educated public. It should be especially useful to general students of science, office men of business, public companies and libraries. The present public interest in just such matters as are treated, should result in a very broad circulation of this stimulating and encouraging little work.

Chemical Engineering Catalog. Published by The Chemical Catalog Co., Inc., 1 Madison Ave., New York City; 886 pp. 1918.

This makes the third annual edition of this work. Each year has shown scientific growth both in the fields of increased subject matter and arrangement. In this edition 228 pages are devoted to the alphabetical listing of specific chemicals, machines and materials used in chemical industries. Under each name is given a very complete list of the principal manufacturers and dealers in this particular material in America. Many firms show a desire to explain in more detail the uses and nature of their products. The second and major portion of the book is devoted to descriptive advertisements and photographs of machinery and units of all kinds as used in the most up-to-date plants. The last twelve pages constitutes a Book Department. Classification is made alphabetically according to the names and authors. This service should be found of special value to firms desiring to equip reference libraries. The general make up of the work shows great care and its annual appearance will undoubtedly be awaited with eagerness by all those who have learned to rely upon its use. The paper is excellent, the pages large (12 in. by 9 in.), and the type pleasing. Nothing seems to have been omitted in making it a serviceable reference of great value to the chemical trade and profession. As an added attraction, the work is loaned without charge for a period of one year to all chemical engineers, works managers, buyers in manufacturing establishments, chief chemists and heads of chemical departments in universities and schools. To those not included in the above classes the cost of the volume per copy is $5.

Chemical, Drug, and Metal Markets

The Quotations below represent average prices for the quantities indicated. Larger quantities may be obtained at lower figures.

Toronto, 8th Nov., 1018.

The Canadian market remains in a generally "sold up" condition. A series of movements have culminated in this effect. In the United States market there is a great shortage of many crude supplies. The American Government is abosrbing larger and larger quantities of materials. Manufactureres cannot possibly fill orders in many lines. The net result is that Canadian buyers cannot get imported materials sufficient to meet normal trade. Added to this, the prevailing epidemic of "flu" has absolutely cleaned out the market in those pharmaceuticals and drugs considered to be of any value for checking or preventing the spread of the disease. Phenacetin, aspirin, camphor, potassium permanganate, are all in this class.

Manufacturing firms are handicapped by close regulation of small quantities supplied by the Government for their use.

Temporary shortage of sodium sulphide is reported. Carbon, tetrachloride and chloroform are only obtainable in very small quantities for general sale.

It is stated that the total output of "chrome" mines has been sold for the next six months. Government action in this connection under Order of October 12 would give Dominion authorities the power to operate these mines as public utilities for a period of five years.

The price of C. P. glycerine has been fixed by the Food Administration of the United States at 58 cents a pound for November and 56 cents for December. The question of the price to be settled for glycerine requisitioned by the allies during 1919 is still pending. 22,000 tons of dynamite glycerine are required.

In paints and paint materials the Government again is taking large orders. The market is steady and no change is expected before the end of the year. Lithopone and zinc oxides are practically sold until the new year.

The gasoline situation has been greatly relieved by the temporary shutting down of Sunday driving. Mr. S. R. Parsons, of the British American Oil Co., Toronto, says: "I believe that the increased demands for war purposes, the large number of new automobiles, the increasing use of tractors and trucks, means that there will be a considerable increase in the consupmtion of gasoline in Canada this year over last year. I do not look for any material increase in prices."

Regulations have been provided for bringing the entire gasoline business under the supervision of the Fuel Controller's department. Retailers' margin will be limited to 10% over wholesale cost delivered.

Acetanilid, C.P.	Lb.	1.10—1.20
Acetic acid,commercial, crude, 28% in bbls	Lb.	10⅜—11 2/5
" " 80 per cent. pure	Lb.	—.29
Acetone	Lb.	.50
Aspirin	Lb.	3.50
Alcohol, grain, bbl	Gal.	8.50
Alcohol, methylated, bbl	Gal.	1.65
Alcohol, wood, 95 per cent., refined bbl	Gal.	1.60
Alum, ammonia lump	100 Lbs.	8 50
Aluminum Sulphate, high grade, bags	100 Lbs.	4 50
Ammonia, Aqua 26°	Lb.	.13—.15
Ammonium Carbonate	Lb.	(Nominal)
Benzoic Acid	Lb.	4.50
Bleaching Powder, 35% drums	Lb.	.04—.06
Borax, crystals	Lb.	.10—.10¼
" powdered	Lb.	.10—.10½
Boric Acid, powdered	Lb.	.16½—.17
Calcium Chloride, fused, in drums	Lb.	.02—.025
Carbolic Acid, white crystals	Lb.	.60—.75
Casutic Soda, ground, Bbl	Lb.	.07½—.08½
China Clay, imported	per ton	$25—$30
Citric Acid, domestic, crystals	Lb.	1.20—1.35
Cobalt Oxide, black	Lb.	1.50—1.75
Copper Sulphate (Blue Vitriol)	Lb.	.11½—.12
Fuller's Earth, powdered	100 Lbs.	6.00
Glycerine, drum (U.S. Gov.)	Lb.	.58
Hydrochloric Acid, carboys, 180	Lb.	.03¼—.03½
Lead Acetate, white crystals		(Nominal)
Lead Nitrate	Lb.	.18—.20
Magnesium Carbonate, B.P., bbl	Lb.	.22—.25
Nitric Acid, 36° carboys	100 Lbs.	.10
Oxalic Acid	Lb.	.42—.45
Potassium Bromide	Lb.	8¾—9½
Potassium Nitrate, Kegs		(Nominal)
Potassium Permanganate, bulk	Lb.	2.75—3.00
Phenacetin	Lb.	6.00
Salicylic Acid	Lb.	1.25—1.50
Soda Ash, bags	Lb.	.03½—.04½
Sodium Acetate	Lb.	.20—.22
Sodium Benzoate	Lb.	4.25
Sodium Bicarbonate, 100% pure	100 Lbs.	4.00—4.50
Sodium Bichromate, bbls	Lb.	.28—.30
Sodium Cyanide, bulk, 98-99 per cent., in cases	Lb.	.33—.35
Sodium Hyposulphite, kegs	100 Lbs.	4.00—4.10
Sodium Nitrate, refined	100 Lbs.	8.00
Sodium Silicate, according to density	100 Lbs.	3.00—3.50
Sulphur, ground	100 Lbs.	3.00
Sulphur, roll	100 Lbs.	4.50—5.00
Sulphuric Acid, 66° Be, carboys	100 Lbs.	3.25—3.50
Tannic Acid, commercial	Lb.	.90—1.10
Tartaric Acid, crystals or powdered	Lb.	95—1.00
Tin Chloride, crystals		(Nominal)
Zinc Sulphate, com	Lb.	.6½—.07

Metals

Aluminum, No. 1, 98-99%	Lb.	.45—.50
" Government price in 50 ton lots for ingot 90-99% A 1	Per ton	$6.60
Antimony	Lb.	.15—.18
Brass, yellow ingots	Lb.	.21—.22
" red	Lb.	.25—.26
Cobalt, metal	Lb.	2.50—3.50
Chrome, 50% high grade	Per unit	$1.70
Cobalt oxide, grey	Lb.	1.65
Copper, casting	Lb.	.30
Copper, electrolytic	Lb.	.30
" Am. Government price (electrolytic and casting	Lb.	.26
Iron, bars	100 Lbs.	5.25
Lead	Lb.	.10¼—.10½
Magnesium	Lb.	1.75—2.25
Mercury	Lb.	2.00—2.50
Nickel, shot or ingot	Lb.	.40—.45
Platinum, pure Goverment price	Oz.	105.00
Silver, bar (U. S. Govt. price)	Per troy oz.	1.01—
Spelter	Lb.	.10—.10½
Steel, mild	100 Lbs.	5.50
" nickel, in bars, 3½% Nickel	Lb.	.25—.27
" Sheet, Bessemer, 28 gauge	100 Lbs.	9.00—9.25
Tin	Lb.	.90—'95
Zinc	Lb.	10½—11½

Canadian Victory Loan

The Ground of the Appeal

From the address of Sir Robert Borden, Toronto, October 27th, 1918

"The sorrow, the sacrifice and the effort of the past four years have been unexampled in our national life, but we have marched on steadfastly through the most momentous events ever chronicled in the world's history, from the days when the first Canadian division left our shores, more than four years ago, to these latest days when the Canadian army, in driving back the hosts of the enemy, is freeing from nameless horrors a population that has been in virtual bondage, not for months, but for years.

"The end is not yet, but the end may not be far distant. Even while I speak to you on this solemn Sabbath Day our gallant soldiers are pressing on in their stern duty and in the final and supreme effort through which alone victory can be grasped.

"Four months ago our fortunes in this war seemed never at lower ebb; to-day our hopes are at the summit of highest confidence. In the unceasing struggle which has brought about this marvellous transformation, Canadians have had a foremost part, and never then or at any other time in all the awful tests which they have endured have they faltered in their duty or flinched from the task set before them. Even those who have seen them on the battlefield, must fail to realize all that they have dared and suffered, their courage, their initiative, their discipline, the scenes of horror through which they have passed, the infinite desolation of No Man's Land, the soul-searching weariness of war so long drawn out, the daily encounter with death itself. And throughout this they have so borne themselves that there is to-day among the armies of the allies no place higher than that which is held by those whom Canada has sent forth. All this they have done and endured that the world may be free, that our own shores, that the cities and towns and countryside of Canada may not be under the awful menace of such an unspeakable desolation as that which my own eyes have seen in France and Belgium. The retreating hosts of the Hun have burnt and plundered and enslaved even while their Kaiser pleaded for peace. God grant that peace may come and that quickly, but not until Germany has learned her lesson.

"We at home have sought to do our part, but how small a part it is compared with theirs. It has been both useful and necessary, but it has been carried out under the conditions of peace which, happily, have prevailed within our borders for more than a hundred years. Our products of the field and of the factory have been in high demand, and notwithstanding the war there has been and there is with us an abundant material prosperity. This war is of nations, not of armies alone, and all the resources of every nation have been thrown unceasingly into the struggle. So now we must call again upon the resources of the prosperity with which we are blessed. We cannot maintain our armies at the front without the necessary provision of financial means to sustain them. The compelling needs of war conditions have imposed upon the nation other vast financial responsibilities. This second Victory Loan may prove in good truth to be the real Victory Loan. It may mark—I hope it will mark—the ultimate effort through which certain victory will be achieved. To make it a success the unceasing effort of every good citizen should be consecrated from this day until the 16th of next November. The man or woman, the boy or girl, who does not aid in that purpose has fallen out of the ranks of good citizenship. The British people have provided by loans thirty billion dollars for war purposes; and neither there nor in any of the Dominions has any war loan ever failed of complete success. While in the United States in recent weeks I was profoundly impressed by the wonderful spirit and overflowing enthusiasm of all the people by their fine unanimity of purpose and action. Not only men and women by the ten thousand, but boys of fifteen, even children of six and seven, had been enlisted in the army of those who strove to make the fourth Liberty Loan the success which it was. And the appeal of these little ones was not the least effective. It is reported that twenty-five per cent. of the population of the United States were subscribers to their recent loan. A like proportion would mean nearly two million subscribers in Canada. Therein is a high example for us.

If we seek a higher, we may find it in the record of those heroic men who have gone forth from our shores and whose spirit, if it inspires us, will raise us far above any thought of failure. Remember their sacrifice and consider that you are not asked to give, but to loan, and that upon the security of your country. The world offers no better to-day. The nation's purpose remains unfulfilled unless this loan makes that provision which is absolutely necessary to keep faith with those who have gone forth with cheerful courage to fight and to endure—yes, perhaps, to die—in order that we at home may live in security and comfort. The nation's purpose has been maintained with strong resolve and with firm heart up to the present. Like the spirit of our army, let it be so maintained to the end."

From the message of Sir Thomas White, Minister of Finance, to the People of Canada.

"Remember, you are asked not to give but to lend your money to the State. Small subscriptions from those of slender means are as welcome as the large. In the last Victory Loan we received subscriptions of over four hundred million dollars from over eight hundred thousand subscribers. This year we expect five hundred million dollars from more than a million subscribers. Let all subscribe to the extent of their means, be they great or small, and once more demonstrate to the world the strength, unity and determination of the Canadian people in this world struggle. Even if the war should end at an earlier date than has been anticipated, all the money asked for will be required for the purpose of demobilization which will extend over many months, and for the continuation of credits for the purchase of Canadian products.

Index to Advertisements

EMPLOYMENT DEPARTMENT

The charge for condensed advertisements of "Engagements Wanted," or "Positions Open," is 50 cents per month for advertisements of 40 words or less, no charge being made for the use of box numbers in care of CANADIAN CHEMICAL JOURNAL.

ENGAGEMENTS WANTED

Practical Metallurgist open for engagement, desires change, and would prefer position in any industrial laboratory, where ability, and ambition for promotion would be recognized. Box 21, CANADIAN CHEMICAL JOURNAL.

Queen's graduate in Chemistry with some industrial experience desires position in laboratory or other connection with a view to permanency and specialization—a position demanding more than average ability and scientific interest.—Box 26, Canadian Chemical Journal.

Chemist, with extensive experience in the textile trade, well up in coloring and the testing of dyes, wools, yarns, and all other produce used in a woollen or cotton mill. Box 24, CANADIAN CHEMICAL JOURNAL.

Practical Analytical Chemist open for engagement. Has had manufacturing experience in pharmaceuticals and drugs. Special experience in the analysis of glycerine and by-products in the manufacture of soap. Enquire Box 25, CANADIAN CHEMICAL JOURNAL.

POSITIONS OPEN

Assistant Chemist wanted for large chemically controlled industry in Maritime Provinces. Salary $1,600. A University graduate, well trained, energetic and resourceful is desired. Previous industrial experience not essential. Apply Box 22, CANADIAN CHEMICAL JOURNAL.

Process Foreman in TNT Explosives or Acid manufacture who desires to connect with a related industry which manufactures a commercial product can communicate with Box 17, CANADIAN CHEMICAL JOURNAL.

Large chemical works requires the services of several chemical Foremen who offer experience in some branch of process work. Must be accustomed to handling men. Good prospects in a permanent industry. State salary wanted and particulars on work you have engaged in. Box 18, CANADIAN CHEMICAL JOURNAL.

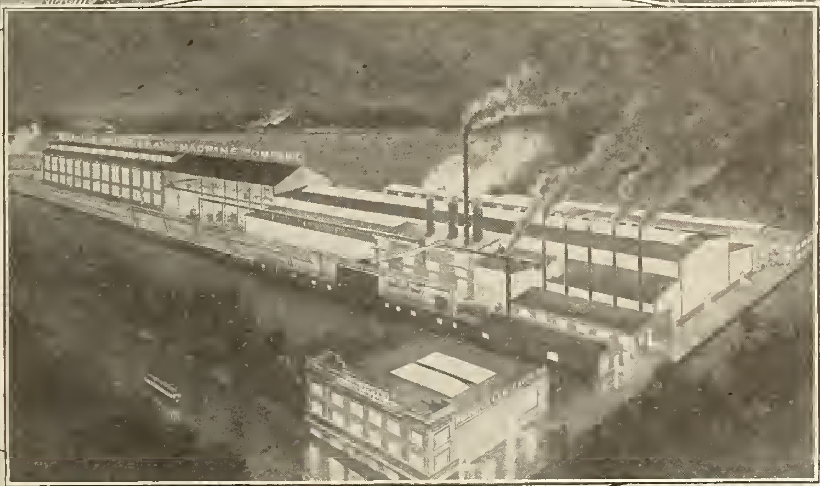
Chemist, not subject to Draft, wanted. Familiar with the recovery of crude glycerine from spent soap lye. Also capable of handling the analysis of fats and oils. Apply Box 23, CANADIAN CHEMICAL JOURNAL.

WANTED—Electrometallurgist and Metallographist required for a Canadian research laboratory. The work will cover extensive investigations on alloys. Good opportunity for the right man. There is also an opening for a graduate in metallurgy to investigate general metallurgical problems. All applications giving education, experience, and salary desired, should be addressed to Box 27, Canadian Chemical Journal, Toronto, Ont.

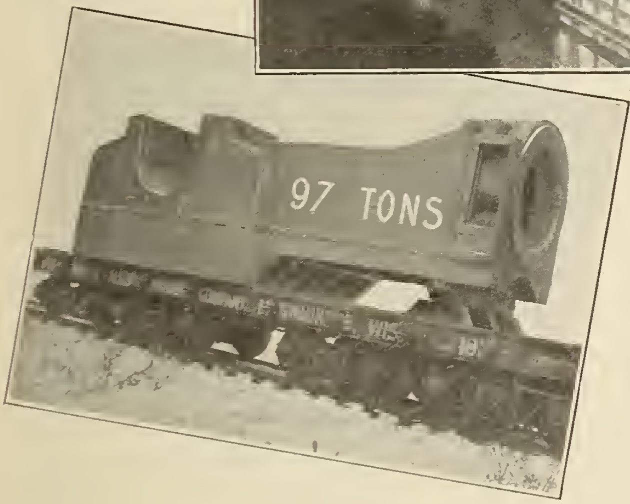
CLASSIFIED INDEX OF ADVERTISEMENTS

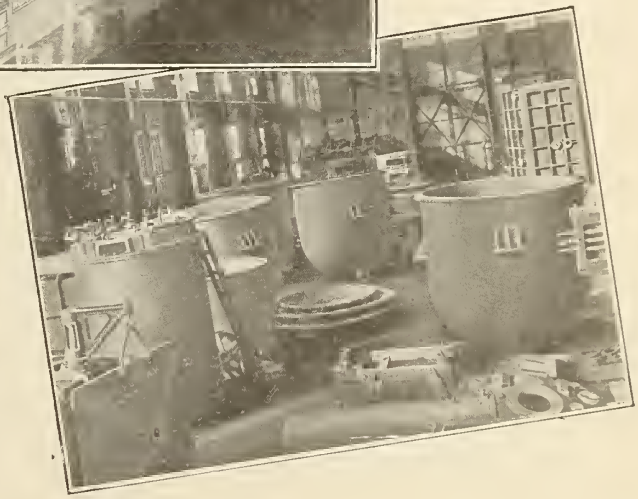
CLASSIFIED INDEX OF ADVERTISEMENTS—*Continued*

"BUFLOKAST"
Chemical
Apparatus



"BUFLOVAK"
Evaporators
and Dryers

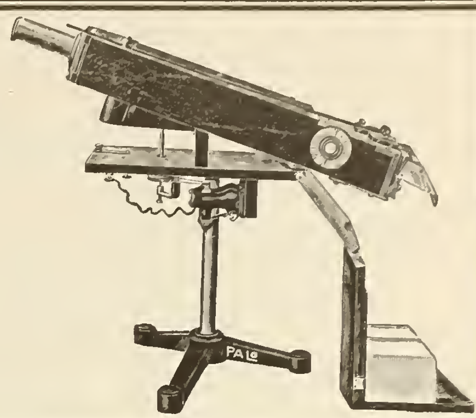


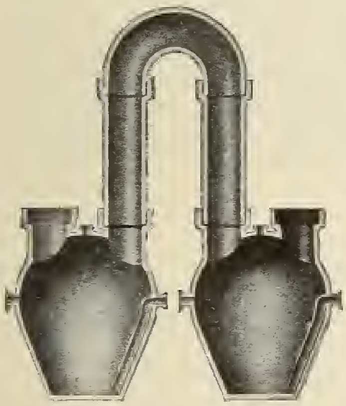


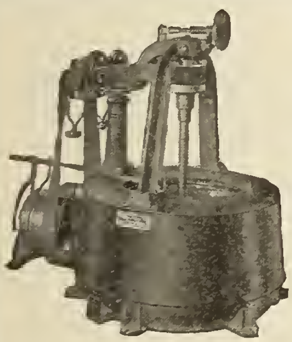
BUFFALO FOUNDRY & MACHINE CO.

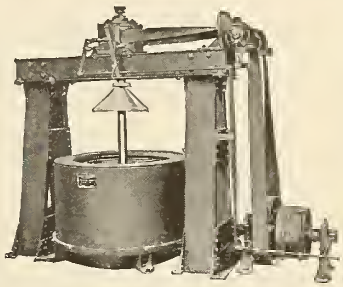
1545 Fillmore Avenue - Buffalo, New York

New York Office: 17 Battery Place


PALO







CANADIAN

CHEMICAL JOURNAL

A Canadian Journal devoted to Metallurgy
Electro-Chemistry and Industrial Chemistry.

Vol. II, No. 12 | TORONTO, DECEMBER, 1918 | 20c. a copy; $2 a year

PROFESSIONAL DIRECTORY

CANADIAN CHEMICAL JOURNAL

A Canadian Journal devoted to Metallurgy Electro-Chemistry and Industrial Chemistry.

Vol. 2 TORONTO, DECEMBER, 1918 No. 12

BIGGAR PRESS LIMITED

540-541 Confederation Life Bldg. - Toronto, Canada

E. B. BIGGAR, Managing Director; L. E. WESTMAN, M.A., A.I.C., Editor

Telephone Main 7399

Subscription price, $2, per year to Canada, and all parts of the British Empire; U.S. and Foreign countries, $2.50 per year.

Time of going to press, 1st of each month. News and changes of advertisements should be in hand one week before.

The Editor would be pleased to receive for publication, original papers from chemists, engineers and managers dealing with the results of Canadian research work or descriptive of Canadian resources and their development in any way. Special arrangements of a very satisfactory nature will be made regarding reprints when required.

All secretaries of chemical organizations are asked to supply the Journal with news regarding meetings held and resolutions passed.

CONTENTS

CHANGE IN RATES TO AMERICAN SUBSCRIBERS

Increased postage rates makes it necessary for us to join the ranks of those journals which charge more for publications going to the United States than those mailed to Canadian points. Most American publications find it necessary to raise their rates to Canadian subscribers on the same grounds. We are therefore making our rates to American points $2.50 instead of $2.00 on and after January 1, 1919. We trust that our American readers will remember this difference when sending in their renewals.

A NEW MARITIME CHEMICAL ASSOCIATION

It has been a great pleasure to record from time to time the growth of the organization spirit among chemists. During the past two years Sections of the Society of Chemical Industry have been established in Ottawa and Vancouver. The chemists of Manitoba have organized independently. The first convention of Canadian Chemists has been held, and a committee appointed to work on the problem of obtaining some kind of legal status for the chemist.

Now we have a new organization in the East. At a most enthusiastic meeting held in the new Science Building of Dalhousie University, Halifax, the chemists of the Maritime Provinces organized themselves as a Maritime Chemists' Association. Representatives were present from the industrial centres of St. John and Cape Breton. Representative committees were appointed to work out a winter program. Professor E. Mackay, of Halifax, was chosen president and H. B. Vickery secretary. We are sure that the whole body of organized chemists in Canada will welcome this new organization and assist them in their common aim. In the new era of society upon which we are entering, there will most certainly be a larger opportunity for the chemist to be more than a laboratory worker. He must produce from his profession more men of business abilities. There is no reason why a thorough training in chemical principles should not lead to a variety of useful business careers,

as surely as any other specific preparation. Organization among chemists themselves should be their first step to larger public service and recognition.

IMMEDIATE PROBELMS IN THE CHEMICAL INDUSTIRES

UNDOUBTEDLY the chemical industries of America have had a situation thrust upon them much in advance of anticipated schedule. We were at war just long enough to lend a pseudo-permanence to large scale production of many things that in a moment have become worse than useless. The United States must have on hand phosgene sufficient to last the world for a generation. Other poison gases or oils cannot seemingly be used in any useful way, and the practical solution of their disposal might well be utter destruction in the Atlantic. We have acid plants sufficient for more than twice normal production. Already the programme for constructing so many large-scale nitrate plants in the United States is abandoned. The new dye industries in America are about to face the true test of their stability.

As far as Canada is concerned, our chemical industries must thrive, not of themselves, but as general industrial work grows. Every import should be thoroughly studied to see how we can possibly supply our own needs at least. It will be a difficult matter to plant and grow specific chemical industries on a large scale here outside of any action the Dominion Government may take regarding the maintaining of certain key industries. It is our hope that eventually our own research work may give us a lead in certain lines. This really seems our opportunity. As Sir Robert Falconer, president of the University of Toronto, stated in a few words before the Royal Canadian Institute recently, we must maintain our reputation in scientific research as well as we maintained our fighting spirit in France, or we are not doing our duty industrially by the men who return. Canada has shown what she can do in one way, and if a fraction of this effort and money is turned along research lines we can more than hold our own in these fields as well. Our problem is simply that which faces the whole world every morning—awake; turn dreams to thoughtful work.

UNITED STATES VIEWS ON CANADIAN RESEARCH LEADERS

THE proposals of the Honorary Advisory Research Council for scientific and industrial research are being keenly observed by representative Americans. Dr. A. B. Macallum has advanced his plans to the point where it is hoped to obtain $700,000 from the Government for a Central Research Institute. Dr. Macallum has shown great perseverance in approaching the Government with his proposals, but unfortunately his aims do not seem to be fully understood by certain scientific publications in the United States.

Chemical and Metallurgical Engineering takes him severely to task in a recent editorial dated November 1st, We quote their comments direct.

Professor Macallum calls urgently and wisely for a great Institute of Research, and along with it he demands a Canadian Bureau of Standards. Now there is an excellent Bureau of Standards in Washington, the British standards are well organized and controlled in England and the two work together in harmony, but we have no desire to discourage the establishment of another bureau in the Dominion. If, however, they were to institute the metric system and were to co-operate with the French Bureau, some of us would wish them God-speed, while others, both in the United States and Canada, might become addicted to tooth-gnashing, for to some minds the metric system is like a red rag to a bull. But there is no intimation of co-operation with France in the report.

Elsewhere Dr. Macallum expresses an opinion that seems to us to be pointed straight in the wrong direction. He says of Canadian industrial establishments that many of them are not in a position to undertake research on a large enough scale to insure results, which is perfectly true, in Canada and everywhere else. He says also that they can enroll themselves in American associations formed for the purpose of solving their problems by research and that some of them have already done so. Also true. He even says that such co-operation *may* be unobjectionable and that there are no international boundaries in science.

It is what follows that pains us. "There are reasons," he says, "why this co-operation cannot be erected into an international system. Some of these concern a cast of psychology inscrutable in the ultimate, if you will, but nevertheless potent in directing a policy on this question. Our people could not ultimately be brought to approve of any proposal, however luring it might appear to them, if also its acceptance involved an effacement of the pride and independence that nationality essentially predicates."

That sentiment appeals to us as rank poison. German propagandists have long been sowing the seed of just such ideas. If honest men of Canada and the United States engage in research for the general welfare, we are simple-minded enough to believe that they can be trusted to proceed without "ultimate" designs upon the well-being or estate or patriotism of their associates. The chicanery he refers to is the kind of chicanery we are fighting to stop. It is intelligent rather than slick or smart or sharp to engage in industrial research. The only safe way to play the industrial game is with the cards on the table. In the "ultimate" many citizens of the United States may move to Canada and vice versa for industrial purposes, and even that is no great tragedy. Both countries can stand it; both have resources enough and to spare without setting up a cry over it. We live side by side, we are neighbors, we are in the same fight for the same good cause and we cannot see the hazard that apparently is the basis of Dr. Macallum's suspicion. We sincerely hope that Canadian organizations for research and study will continue to welcome Americans as members and that our neighbors in applied science will continue to affiliate with such establishments on this side of the border. Let us put no barriers in the way of industrial research. We regret that Dr. Macallum has taken the attitude displayed in his official report.

We are very sorry indeed that such a leading journal should have this conception regarding the work Canada is trying to do for herself along research lines. We have sat at the table of all our international relations for some time, and it should not be taken as "heresy" neither should it "pain" them unduly

if, in the natural course of events we desire to work out our own salvation and develop some pride and independence in solving our own particular industrial problems.

Canada is more than willing to continue to co-operate with the United States, both nationally and individually in all matters of research, but it is very essential that we have research work under way here before we can have true co-operation. We have co-operated in the past most beautifully by supplying the United States with many valuable raw products and in return have even supplied a market.

It is nonsense to even suggest that Canadian organizations for research will not always welcome Americans as members and as true neighbors. This spirit, however, is not likely to be fostered long if our simple little efforts at "pride and independence" are dubbed "rank poison" and "German propaganda." Our American friends should appreciate a spirit of "healthy rivalry" as such, and not fly off on such a wild tangent with so little provocation.

A PLEA FOR OUR ELECTRO CHEMICAL INDUSTRIES AT NIAGARA FALLS

Editor Canadian Chemical Journal:—

Dear Sir:—

Month after month the Canadian Chemical Journal emphasizes the importance to Canada's industrial welfare of electro-chemical development. Under these circumstances it seems strange that no chemist, so far as the writer is aware, has protested against a policy that tends to retard electro-chemical industry at Niagara Falls, Ontario.

The professed policy of the Hydro Electric Commission is to distribute Niagara energy as widely as possible throughout Ontario. The realization of this policy means loss of energy through long distance transmission and loss to Canada by the use of Niagara's energy for purposes to which it is not so well adapted as to the manufacture locally of electro-chemical products. There is no objection to the long distance transmission of a due proportion of this energy, but it is time for electro-chemical interests to demand their share when bitter complaints are made in influential quarters because the Ontario Power Co., has been compelled to provide an adequate amount of power for the American Cynamid Co., at Niagara Falls, Ontario, although the product of this Company are essential for war purposes.

At the risk of wearying you by vain repititions let me again point out some of the advantages and the feasibility of a ship canal at Niagara Falls.

Under the present canal scheme of the Hydro Electric Commission, the Chippawa Creek, (Welland River), will be navigable by ocean vessels from its mouth, at Chippawa to Montrose, a distance of two miles, roughly estimated. The new Welland Canal will provide another navigable strip of water on the Chippawa Creek from Welland to Port Robinson, leaving a short un-navigable gap between Port Robinson and Montrose. The banks of the navigable strip at the Chippawa end of the Creek would furnish excellent factory sites for electro-chemical products as Niagara Power would be available without stepping up the voltage. But, although this strip is navigable, no provision is made for allowing vessels to reach it. This could be remedied by making navigable the gap between Port Robinson and Montrose, by placing the dam and lock of the new Welland Canal at Montrose instead of at Port Robinson. The feasibility of this is proven by the offer of the late Dominion Government, through its responsible Minister of Railways and Canals, to place the lock at Montrose on the absurd condition that the municipalities of Niagara Falls and Stamford pay the land damages. Now why should the whole country suffer through a lack of team play between the Dominion Government and the Hydro Electric Commission?

Another strip of navigable water could be supplied by broadening and deepening the hydro-power canal for a distance of nearly two miles from Montrose to within a short distance of Niagara Falls. Beyond this point there would be enginreeing difficulties. The banks of this strip, having both rail and water facilities, and being within the range of territory wherein stepping up of voltage would be unnecessary, would provide further ideal facilities for electro-chemical industries.

It may be asked why these industries could not be maintained more economically at towns on the Welland Canal proper. The reason is that voltage is increased for purposes of transmission to these towns and then stepped down again. Since the new plant of the Hydro Electric Commission will be at Queenston, it might seem logical to expect electro-chemical industries to be established at that place, or at Niagara-on-the-Lake, or on the banks of the Niagara River between those places. Inadequate railway facilities, current difficulties, and lack of suitable harbourage, added to the fact that land which might furnish factory sites has already been pre-empted by the Victoria Park Commission, make such development impossible.

Is it unreasonable to hope that our chemists will insist on such modification of the Hydro Electric, and Welland Canal schemes as will give electro-chemical industries a fair chance of securing its share of Niagara energy?

Oct. 28th, 1918. A. N. Myer,

Sec. Stamford Board of Trade,

Niagara Falls, South, Ont.

NOTES FROM NEW YORK

(Correspondence of the Canadian Chemical Journal, by F. M. Turner, Jr.)

November 28, 1918.

The restrictions on bleach, chlorine, etc., which have seriously affected the pulp and paper and textile industries, have been removed, according to Mr. H. G. Carrell, who is in charge of the Alkali and Chlorine Section of the Chemical Division of the War Industries Board.

It has been officially announced that no price will be fixed on glycerine for 1919. This does not affect contracts at piesent existing between manufactuiers and the Government.

Edward H. Childs, of New York City, an attorney, has been appointed by the creditors of Herman & Herman, Inc., bankrupt manufacturers and dealers in chemicals and dyestuffs. The assets of the firm are considerable, and the business will be carried on in the inteiest of the creditors.

Dr. William H. Nichols, of the General Chemical Company, is entertaining the members of the Council of the American Chemical Society at dinner at the Chemists' Club on December 14th. The object of the meeting is to discuss the relation of the Ameiican Chemical Society to the work of reconstruction.

The following concerns of importance in the chemical industries are being, or have been, sold by the Alien Property Custodian: Bayer Co., New York; International Ultramarine Corporation, New York; Heyden Chemical Works, Garfield, N.J.; Brunswick Chemical Co., New Brunswick, N.J.; Bauer Chemical Co., New York; Synthetic Patents Co., New York. All of these properties will thus pass into the hands of ieliable American citizens. The changes in ownership will be widely advertised so that the goodwill of the companies will not suffer. A block of stock in the General Ceramics Company held by German owners, has also been ordered to be sold.

Government Nitrate Plant No. 2 was formally turned over to the Ordnance Department of the army early this month. The plant had been in operation over two months before the contractors formally transferred it to the Government. This plant is the second of the large plants built in the South, and is located at Muscle Shoals.

Some anxiety is felt at Cincinnati as to whether the large Government nitrate plant under construction near there will be abandoned now that military operations have come to a close. Local business men are anxious to have the plant completed and run in times of peace for industrial purposes. Quite a model town had grown up at the site of the plant.

The New York Section of the American Chemical Society held a meeting at the Chemists' Club, New York, November 8, 1918. After nominating officers for the Section for the ensuing year, a series of short addresses was given on the subject of research, and the drug industry. Dr. P. A. Lavine, of the Rockefeller Institute for Medical Research, and a number of representatives of important drug manufacturing firms spoke.

A handsome hall clock has recently been installed at the head of the main staircase of the Chemists' Club. The mechanism of the clock is the workmanship of Dr. Thos R. Duggan. Dr. Duggan, besides acting on the House Committee of the Club and serving the Permutit Co. as chemical director, is an expert clockmaker and this handsome gift is only one of many examples of his skill. The beautiful case in which the works are installed is the gift of Dr. M. C. Whittaker, Past President of the Chemists' Club.

T. E. O'Reilly, of the Chemical Products of Canada, Ltd., was a visitor to New York last week.

A. P. Perry, until recently Vice-President of the Barrett Co., died recently in Cleveland, O. Mr. Perry was one of the pioneers of the coal tar industry in America. He was interested in tar distilling plants in Boston, New York, and Cleveland, and was one of the founders of the present Barrett Company. He introduced the handling of coal tar in tank cars. He was born in New Hampshire in 1840 and was a veteran of the Civil War. He did a great deal to promote research and his factory at Cleveland was the first tar plant in the country operating a laboratory.

Subsequent to the death of Mr. William Garrigue, the firm of William Garrigue & Co., chemical engineers, specializing in soap, oils, etc., has passed into the hands of Chicago interests who are planning to carry the business on and expand its activities. The head office of the company is to remain at New York, but a branch is being opened in Chicago to take care of business in that section.

William Garrigue died October 2nd, while at Toronto, Ont., on business, from pneumonia contracted while travelling. He was born in 1872 at Copenhagen, Denmark, his parents removing to America when he was a child. His father was a noted physician in New York. He was educated in the public schools of New York and at Columbia University. Early in life he was interested in mining engineering and chemistry, but soon became identified with the soap and glycerine industry, being in charge of the plant of W. & H. Walker, Herr's Island, Pittsburgh, Pa. Following that he practised chemical engineering in Detroit, Louisville, New Orleans and finally New York, where he founded William Garrigue & Co. His contributions to the soap industry are very numerous and important and there is hardly a large soap plant in the United States or Canada that does not embody some of his ideas or use some of his equipment.

Some of his most noted contributions to chemical engineering have been: The principle of double effect glycerine evaporation, a process for distilling glycerine which has supplanted the old Jobbins still by using vapor from the concentrator as the injected live steam for the still; thus doing away with using fresh superheated steam. Separation of trimethyleneglycol from glycerine. Recovery of dynamite glycerine from cotton-seed soap-stock spent lye. Reversible double effect evaporation for spent soap lye. Combined evaporation of caustic soda, lye and spent soap lye in triple effects. Direct autoclaving of cotton-seed soap stock before distilling fatty acids. Also many improvements in the construction of evaporators and extractors. He also built a complete garbage recovery plant for the City of Erie, Pa., and a plant for recovering potash from molasses distillery waste in Louisiana, the first of its kind in America.

He was a member of the American Institute of Chemical Engineers, American Chemical Society, Chemists' Club of New York, New Orleans Country Club, Southern Yacht Club and Lakeshore Club of New Orleans. He was exceedingly fond of outdoor sports such as yachting, hunting and fishing. Moreover he was a man of very broad interests having a lively appreciation of all that was best in literature, science and art. His views on public questions were liberal almost to the point of radicalism and always interesting. The chemical profession and industry have sustained a loss in his death that only those who knew him intimately will understand.

H. D. Ruhm, of Marden, Orth and Hastings Corporation, New York, has been elected President of the Calco Chemical Company, a subsidiary manufacturing dyestuffs.

Construction on the Navy's $9,000,000 .plant for nitrates at Indian Head, Md., has been stopped, owing to the cessation of hostilities.

According to the reports of the Transfer Tax Returns, the late Dr. James Douglas, of New York, well known throughout Canada in mining, chemical and educational circles left the following estate:—Cash $670,255, Liberty bonds $961,000, bonds $468,498, and stock $15,172,000, making $18,635,722.

The Westinghouse Electric & Manufacturing Co., East Pittsburg, Pa., has recently opened a new building devoted to research. It is one of the best equipped buildings of its kind in the world. It includes laboratories for inorganic and organic chemistry, metallography, metallurgy, magnetism, electricity, illuminating engineering, together with workshops for glass-blowing, metal working and carpenter work. There are also fine library and office accommodations for the staff. A more complete description will be given later.

Mr. W. P. Cutter, formerly librarian of the United Engineering Societies' Library, New York, is now connected with the Chemical Catalog Company, Inc., New York, and is in charge of the Book Depatment.

L. A. BROWNE HOME FROM OVERSEAS

The many friends of Mr. L. A. Browne in Ottawa, are welcoming him back to the city after a term "over there." Mr. Browne, who was one of the chemists employed in the Chemical Laboratories of the Experimental Farm, enlisted with the Fourth University Company in September, 1915, and was attached to the Princess Pats with which unit he went overseas. He was wounded in the now well-known battle of St. Sanctuary Wood on the second of June, 1916, and after he received his discharge from hospital he went to work in H.M. Factory at Craigleith, Scotland, on the production of T.N.T. At that time this factory was the only one employing the two-stage process. In January, 1918, he went to London where he was engaged in the preparation of "Mustard Gas," and until such time as the process there used was discontinued. Shortly after he was withdrawn by the Ministry of Munitions and returned to the Laboratories at Ottawa. He arrived on the 30th of September at New York, and is now renewing acquaintance with his many friends. Mr. Browne is to be congratulated on not having come back alone, and the Canadian Cehmical Journal joins in the good wishes for a long and happy sail on the matrimonial sea.

Commercial Uses of Chlorine*

By V. R. Kokatnur, Research Chemist, Niagara Alkali Co., Niagara Falls

The electrolytic manufacture of caustic so daduring the last decade or so has brought such new problems to the fore, which if not solved immediately seem to threaten the very life of the industry that has given them birth. The electrolysis of brine produces caustic soda, hydrogen and chlorine. Caustic soda produced by the Solvay process is decidedly cheaper than electrolytic caustic; · while electrolytic chlorine can be made cheaper than chlorine made by other methods. Thus it is easy to see that the success of electrolytic alkali industry depends, not so much upon the profits obtained from caustic, as upon those from chlorine. Though the main object in the electrolysis of brine is caustic soda, chlorine thus assumes a greater importance in the electrolytic alkali industry. In other words, the evaluation of the products of electrolysis of brine depends not so much on our motive of electrolysis as on the practical side of the question. Hence chlorine becomes important as a primary-product, since among the products of electrolysis, it is at the same time the most important and the cheapest. After all, the question whether a product should be called a prlmary-product or a by-product is settled by the cheapness of manufacture and utility of that product, and from this standpoint chlorine can be called a primary product and not a by-product. While hydrogen can be thrown away without much detriment to the neighbouring community, chlorine cannot be so dealt with, even if it was so desired, on account of the expensive damage suits such a step may involve. It is another thing that we cannot afford to throw it away, since electrolytic caustic cannot successfully compete with Solvay caustic unless its allies, hydrogen and especially chlorine, reinforce and strengthen its ranks.

We are thus confronted with a double necessity of utilizing chlorine, first because we cannot afford to throw it away, and secondly because we cannot throw it away without serious trouble even if we wanted to. The unprecedented stimulus given to the chemical industry as a whole by the present war, and its certain growth after the war, will undoubtedly expand the electrolytic alkali industry beyond its present confines. Such a growth wlll result in an enormous production of chlorine. The present uses of chlorine in the production of bleaching powder or hydrochloric acid cannot further be extended without seriously overflooding the world's markets, besides not being very profitable. Thus we are confronted with a problem, stupendous as well as most vital to the life of the alkali industry, a problem which if not soon solved, will mean a sure though slow death to the industry, a problem which is so fraught with grave consequences and pregnant with stupendous possibilities, a problem of finding new and profitable uses of chlorine.

This paper does not claim any originality in its contents. Its main object is to present a systematic treatment of the possible ways of utilizing chlorine, showing the avenues and by-paths. Some of these by-paths show signs of considerable traffic, while others are hardly used and show but few footprints. The known roads are the ones that are followed by many as they offer the least resistance. None but the daring explore the new roads, lest they may lead them astray to be lost in the wilderness. As in everything else, it is the new roads that open up fields of profitable endeavour and the chlorine industry is no exception.

Uses of Chlorine

Direct	Indirect

a	b	c	d	e
Ores	Poisonous Gases	Org. Compounds	Inorganic Chlorides & Chlorates	Independent Uses

1	2	3	4
Solvents	Pharm. Chemicals	Coal-tar intermediates	Synthetic Intermediates

This table shows the classification of the different ways of possibly utilizing chlorine. Some of these look like footpaths and have a small and limited application, while others appear like beautiful and broad avenues, on which one can travel far and wide, nay, can even cross the continent.

Direct Uses

Independent Uses:—

(e) Among the direct and independent uses of chlorine may be mentioned its use as a bleaching agent in water solution in the textile and paper industries. It finds use as a disinfectant and sterilizer of potable water, whereby typhoid, cholera and other epidemic diseases are completely eliminated from cities wherever it has been used. Recently it has been used in the treatment of wounds and their asepsis through what is known as Dakin-Carrel solution. Liquid chlorine is known to have been used in gas-warfare in producing smoke-screens or clouds. It can be used in fumigating houses and thus destroy the dangerous microbes of plague and other diseases.

(a) Chlorination of Ores:

There have been many patents on the chlorination of ores for specific purposes in metallurgy. There seems to be a vast field in this line as a large tonnage of chlorine will be consumed in any such line in which it may find application. It has been used for the separation of gold or silver from other base metals and thus finds an indirect application in the metallurgy of gold and silver. It is also used in separating copper from nickel, i.e., in the metallurgy of both copper and nickel. It is used in separating tin as tin-tetra-chloride from tinned iron-scrap by what is known as Goldschmidts' Detinning Process. It finds application in the extraction of valueless ore-residues, which could not be profitably worked ont but by the use of chlorine. Thus a low per cent. ore can be worked out successfully to advantage by its use and its valuable metal-contents be made available for human use. The chlorination of ores can be extended *ad infinitum* to newer fields of adventure, taking advantage of the fact of volatility of certain chlorides and the action of chlorine on different metals and metallic oxides. Thus perhaps iron-pyrites may be used for iron manufature and felspars may some day give us our potash and aluminum.

(b) Poisonous Gases:

The gas warfare is perhaps the most unforeseen development of the present war and opens up interesting fields. It is interesting to note that more than fifty per cent. of the known gases used in the present war are chlorine compounds. Silicontetrachloride $SiCl_4$ and titanium-tetra-chloride $TiCl_2$ are used in producing smoke-screens. Chlorosulphonic acid SO_3HCl is used in hand-grenades and smokepots. Phosgene $COCl_2$ is used in shells as an offensive gas. Chloraceton $CH_2ClCOCH_3$ is used in hand-grenades. Both chloro-methyl-chloro-formate $CH_2ClOOCl$ and trichloromethylchloroformate $Cl{-}COOCCl_3$ known as superpalite are used in shells as lachrymators. Benzyl chloride $C_6H_5{-}CH_2Cl$ is used as a tear-gas in shells, chloropicrin or nitrochloroform $C(NO_2)\ Cl_3$ also as a tear-gas in shells, mustard gas, i.e. dichlorodiethylsulphide $(C_2H_4Cl)_2S$ in shells for both offensive and neutralization, diphenylchlorarsene $(C_6H_2)_2{-}AsCl$ in shells as a "sneezing gas," Phenylcarbylamine-chloride $C_6H_5NCCl_2$ in shells as lachrymator, dichlormethylether $(CH_2Cl)_2O$ in shell and methyl-chloro-sulphonate CH_3ClSO_3 in hand grenades. The other so-called gases are benzylbromide $C_6H_5CH_2Br$ in shell, bromaceton $CH_2BrCOCH_3$ in hand grenades, bromo and dibromoketones like $CH_2BrCOC_2H_5$, $CH_2CO{-}CHBrCH_2Br$ in shell, xylylbromide $CH_3C_6H_4CH_2Br$ in shell, allylisothio

cyanate C_3H_5NCS in shell, dimethysulphate $(CH_3)_2SO_4$ in hand grenades, and sulphur-tri-oxide SO_3 in hand grenades and shell. It has recently been found out that Cyanogenchloride and butyl mercaptan are also used. It will be noticed here that many of these non-chlorine gases are capable of being produced form chlorocompounds, i.e., using chlorine in intermediate steps. Thus for example, allylisothiocyanate can be prepared from allyclhloride and KCNS, methylsulphate from methyl-alcohol and sulphuryl-chloride, benzyl-bromide from benzyl-chloride and KBr and so on. Hence it would not be far from truth to say that more than 95 per cent. of the poisonous gases can be made directly or indirectly by the use of chlorine.

It is to be deeply regretted that these gases should have been used for incapacitating or destroying human beings. We would not be considered foolish, I hope, in expecting these horrible gases to serve us a better purpose. There is no reason why they cannot save us and our crops from the ravages of microbes and insects as they are saving us to-say from the ravages of Prussian militarism. We must not forget that our worst enemies turn out to be our best friends when controlled and directed rightly, as some of the worst poisons like strychnine and morphine have proved to be in our day.

(d) Inorganic Chlorine Compounds:

There are many metallic and non-metallic chlorides that have found an extensive application in arts and industries. Chloride of lime or bleaching powder, as it is sometimes called, is used extensively in bleaching, as its name indicates. It is used also in purifying water, as a disinfectant, and in many cases as an oxidizing agent. It is also used advantageously in chlorination of basic substances like amines to produce chloramines and gives, many a time, quite different results from ordinary chlorination. Sulphur-mono-chloride S_2Cl_2 is used extensively in vulcanizing rubber and making rubber substitutes from oils and fats. It is also used in deficating cane-juice, sugar refining, and preparing the surface of tobacco pouches and tubes. It can advantageously be used in the preparation of chlorides free from oxychlorides. It may also find an application in preparing organic sulphides. Sulphurylchloride SO_2Cl_2 and thionylchloride $SOCl_2$ can be used in the preparation of acid chlorides from acid salts and as chlorinating agents. Sulphurylchloride can be used in the manufacture of acetic anhydride from sodium acetate, an invaluable ingredient in the manufacture of dyes, cellulose acetate and the manufacture of drugs. $4CH_3\text{-}COONa + 2SO_2Cl_2 = 2(CH_3CO)_2O + 2NaCl + Na_2SO_4$. Phosphurus chlorides such as phosphorous trichloride PCl_3, phosphorous pentachloride PCl_5, and phosphoryl or phosphorous oxychloride $POCl_3$ are all used as chlorinating agents, particularly valuable for the substitution of hydroxyl or oxygen by chlorine. Thus they can be used to prepare ethylchoride from alcohol or ether and acid chlorides from fatty acids. Antimonytrichloride or butter of antimony $SbCl_3$ is used as caustic in medicine, in the preparation of tartar-emetic and as a "bronzing solution" for gun barrels and other instruments. Antimony-pentachloride is used as a chlorinating agent, many a time, to serve the purpose of phosphorous chlorides. Anhydrous aluminum chloride is used extensively in organic synthesis and recently has found an application in the "cracking" of petroleum oils to obtain gasoline. Ferric chloride can be used for similar purposes. Tin-tetra-chloride $SnCl_4$ is used in cotton-printing and silk dyeing, while stanuous chloride $SnCl_2$ has an extensive use as a reducing agent. Zinc chloride is used for the impregnation of wooden telegraph poles and railway ties; zinc oxychloride is used as a cement in dentistry. Mercuric chloride $HgCl_2$ and calomel Hg_2Cl_2 are both used as antiseptics and in medicine. Silverchloride in its colloidal form is used extensively in photography. Other chlorides have not yet found an industrial application. Sodiumhypochloride is used extensively in solution for bleaching and as an antiseptic, but if solid sodiumhypochloride could be produced it would be extremely valuable. So far no attempt seems to have been made in this direction, but the day is not far distant when it will be manufactured in quantities. Different chlorates like those of sodium, potassium, calcium and barium are used in the manufacture of matches, cartridges, fireworks, dyes and as lozenges in sore throat. Perchlorates also are being used more and more. Ammoniumperchlorate is perhaps the most economic and at the same time the most terrific of explosives. It is destined to play an important part in industrial arts; like mining, in the near future, especially as there is, owing to war, a great depletion of animal fat, the glycerin from which goes to make our dynamites. It is surprising that our government should not have taken any steps in this direction.

(c) Coal-tar Intermediates:

Among the most important coal-tar intermediates may be mentioned a derivative of benzene called chlor-benzol. It finds an extensive use in dye industry and in the manufacture of picric acid. Dichlorbenzols have not so far found any industrial application. It is needless to say that the still higher chlorobenzols are worse off in this respect. It seems that monochlor-benzol may find application as a solvent, as it can be manufactured cheaply and as it is a more stable compound than aliphatic chlorides which generally decompose in the presence of moisture and light. Chlor-toluenes like benzylchloride $C_6H_5CH_2Cl$ can be used to make benzyl-alcohol, which has a good demand in the essential oil industry. Benzolchloride $C_6H_5CHCl_2$ is used to manufacture synthetic oil of bitter almonds or benzaldehyde, which is also used in vast quantities in perfume industry. Benzotrichloride or phenylchloroform $C_6H_5\text{-}CCl_3$ is used to manufacture benzoic acid. Chlorobenzoic and salicylic acids have a limited application. Chlorphenols and cresols are used in synthetic work. Recently some chlor-napthalenes have been used as solvents and in making waxy condensation products for insulation purposes. Chlor-napthalenes may open up new fields as starting points of the dyes of napthalene series. Chloranilines have a limited application in dye industry, while chloranil or tetrachlorobenzoquinone has a great demand. The chlorination of anthracene may also open up new fields in the dye industry. Chloracetic acids are extensively used in dye manufacturing. Monochloracetic acid plays an inmportant part in the synthesis of indigo. Dichloracetic acid is used in the synthesis of isatin. Trichloracetic acid is also used extensively. Phosgene $COCl_6$ is used in triphenylmethane dyes and in the synthesis of acids and ketones.

(2) Pharmaceutical Chemicals:

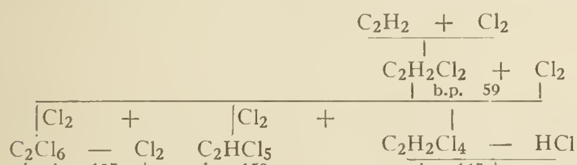
Very little attempt has been made to bring chlorine compounds of pharmaceutical value on the market. In this line chloroform must be mentioned as one being extensively used as an anaesthetic. It is also used as an antiseptic and is even used internally in medicine. It is also used in dentistry. Chloral CCl_3CHO finds application as a hypnotic or soporific. Both chloral and chloroform are at present very expensive and a cheaper method to manufacture them would be a boon to humanity. Methylenechloride finds some use as a local anaesthetic. Ethylchloride is used also as a local anaesthetic and in conjunction with others as a hypnotic in somnoform. Isopral or trichlorisopropylalcohol $CCl_3\text{-}CHOH\text{-}CH_3$, chloramide or chloralformamide $CCl_3\text{-}CHOH\text{-}NH\text{-}CHO$ chloralimide CCl_3CHNH and dormiol $CCl_3\text{-}CH(OH)O\text{-}C(CH_3)_2C_2H_5$ are used in various ways in pharmacy. Ethylene-chloride $C_2H_4Cl_2$ or "Dutch liquid" as it is called, is used as an inhalant and local anaesthetic. Chloretone or acetone-chloroform $CCl_3(CH_3)_2\text{-}COH$ is used as a local anaesthetic in conjunction with cocaine and adrenaline. Chlorphenals and cresols are antiseptics of great value, being several times stronger than phenols and cresols and yet are free from their toxic effects. Some chlorinated oils have been tried in Europe for their medicinal value. Many chlorine compounds like hexachlorethane and hexachlor-benzol are likely to be useful as either antiseptics or vermin-killers or in both. They may find an extensive application in the washing and sterilization of milk cans, as

chlorine-solvents are good fat-extractors and antiseptics at the same time. Dichloramine-T or p-toluene-sulphon-chloramide has been recently used by Drs. Dakin and Carrel in the asepsis of wounds. It is a non-irritating synthetic germicide and corresponds to the antiseptic chloramine substances that are formed when hypochlorous chlorine is brought in contact with the exudate of suppurating wounds. It can be used in doses twenty or forty times stronger than in hyhochlorite solution. It has absolutely no destructive effect on tissue-cells like tincture iodine. It is used also as a nasal antiseptic. It has been found to be better than bleaching powder for the purification of water, because of its stability in solution, non-toxicity, absence of corrosive action and non-production of unpleasant taste.

(1) Solvents:

The most extensively used chloro-solvent is carbon-tetrachloride CCl_4, a compound which is made by the action of chlorine or sulphur-mono-chloride on carbon-bisulphide CS_2. It is used as a solvent in rubber industry and for the extraction of fats. It is also used in dry-cleaning and in fire-extinguishing mixtures like "Pyrene." Chloroform $CHCl_3$ is used to a limited extent as a solvent in electrotechnics, rubber-industry and photography. Methylene chloride, though a good solvent, has not a supply to cope with its demand if created. Ethylene-chloride or "Dutch liquid" $C_2H_4Cl_2$ is a solvent of great value and resembles carbontetrachloride in most respects and is a good solvent for cellulose acetate. It can be made cheaply by chlorinating ethylene gas obtained by either cracking oil gas or by the limited hydrogenation of acetylene. Besides being a solvent of great value, it is very useful in the synthesis of commercially useful chemicals like glycol, a lower homologue of glycerin and malonic acid, a reagent of great importance in the synthesis higher fatty acids by what is known as "malonic acid syntheisis." Glycol-chlorhydrin, another derivative, is a good solvent of both cellulose-acetate and nitrate and is used considerably in the explosive industry. From chlor-hydrins can be prepared solvents called olefin oxides which are solvents resembling ether. Taurine $CH_2NH_2CH_2SO_2OH$, a protenoid substance occurring in ox-bile, can also be synthesized from it.

In recent years chlor-ethanes and ethylenes have been extensively used in Europe as solvents in various arts. Among this series of solvents is one made from acetylene and chlorine called acetylene-tetra-chloride or tetrachlorethane. It is the parent substance of this series of six and is perhaps the best known solvent for cellulose-acetate, and as such is used in making the non-inflammable and non-explosive photographic and motion picture films, and also in the manufacture of "aeroplane dopes," i.e., the varnish for aeroplane wings. Pentachlorethane, its higher chlorine derivative has special properties as a solvent for cellulose-acetate. It plays toward cellulose esters, the part that camphor does towards nitro-cellulose. Non-inflammable photographic films of cellulose-acetate containing as high as (12%) twelve per cent. of acetylene-tetra-chloride have been prepared at Rochester. It is known to give certain resilient qualities to the plastic cellulose-acetate that no other solvent is known to do.



Sulphur mizes in all proportions with tetra-chlor-ethane at an elevated temperature and crystallises out from solution on cooling. Thus it can be used to extract sulphur in various arts.

They are all good solvents for rubber. Particularly so is dichloro-ethylene, which was found to be the best solvent for crude cachouc by Emil Fischer. It is thus used in making insulating varnishes and also in the extraction of perfumes from flowers. No better solvent than trichloro-ethylene can be found for the extraction of fat. It extracts fat from dry or moist material and whether in a liquid or a vapour form. It is just as efficient as ether and entails but little loss by evaporation. It has the advantage over carbon-tetra-chloride inasmuch as it boils about twelve degrees higher, has a lower specific gravity and consequently requires less alcohol and leaves smaller amounts of the solvent on the filter. Further, while carbontetrachloride attacks iron vessels in the presence of moisture, trichloro-ethylene does so very little. With its freezing point as low as 79° C., its boiling point a little higher and being less corrosive on metals, it forms an ideal fire-extinguisher in mixtures like "Pyrene." Tetrachloro-ethylene is an ideal dry-cleaning solvent. The solvent power of tetrachlorethane in the case of fats, resins and waxes, is believed to be superior to that of carbon-tetra-chloride. Thus it has been used in the manufacture of paints and varnishes, in boot and metal polishes, in furniture cream, as a paint remover and in cleaning printing rollers and lithographic stones. It does not affect even the most delicate shade and thus can be used in the manufacture of white enamels and paints.

These solvents offer great advantages over the other known solvents, as they have a wide range of boiling points and solvent power. They are non-combustible, non-inflammable and non-explosive substances. They have a sweet aromatic odour, and have no offensive smell of sulphur or other impurities. They are uniform compounds and not mixtures. They have particularly great solvent power for sulphur at elevated temperatures.

They dissolve phosphorous, iodine, thirty (30) volumes of chlorine, all hydrocarbons, waxes, resins (like Kauri, copal, sandarac, damar and shellac), alcohols, fats and oils, fatty acids, dyes and purine derivatives. They have found great application in analytical work such as in the separation of dyes, fatty acids from hydroxyfatty acids, phenols from polyhydroxy-phenols, caffeine from other purine derivatives, and so on.

Besides being useful for such a variety of purposes, they open up an extensive field in the synthesis of valuable products. Dichloro-ethylene can be used to synthesize thioindigo from thiosalicylic acid thus:—

$$2\ C_6H_4<^{SH}_{COOH} + C_2H_2Cl_2 = C_6H_4<^{S}_{CO}>C=C<^{S}_{CO}> C_6H_4 + 2\ HCl + 2\ H_2O.$$

Trichloro-ethylene can be used to synthesize ethylchloroacetate $CH_2ClCOOC_2H_5$, dichloro-acetic acid and phenylglycinester $C_6H_5NHCH_2COOC_2H_5$, which is the basis in the synthesis of indigo. It is important to note that acetylene is very much cheaper than acetic acid as a starting point in the synthesis of indigo. Tetrachloro-ethylene can be used to synthesize trichloro-acetic acid. Hexachlorethane can be used to make oxalic acid.

Chlor-compounds of the higher homologues of ethane will not be cheaply available on account of the scarcity of raw material and can only be made as by-products of coal-gas and oil-gas chlorination. When we reach as high as hexane, their chlorine compounds are either solids or liquids of very high boiling points and consequently will not be much useful as solvents. The unsaturated chlorocompounds of higher hydrocarbons, however, may find some application as they have a lower boiling point than saturated chloro-compounds. It is safe to say that chloro-compounds as solvents will never find an extensive application when made from hydrocarbons higher than pentane.

Compounds like chlorinated stearic acid are used as solvents in the manufacture of phonographic records and also in paints to prevent metallic corrosion. Chlorinated eucalyptol is used as a solvent for dichloramine-T. Other chlorine compounds like chloro-ethers, chloro-aldehydes, chloro-alcohols, etc., have not found any application as solvents.

(4) Synthetic Intermediates:

There are many organic chlorine compounds, which though incapable of being used as such in arts and industries, are nevertheless very useful as intermediate products in the manufacture of other commercial products. Most chloro-hydrocarbons can be used to make unsaturated hydrocarbons of value. Organo-metallic compounds like zinc methyl ($Zn(CH_3)_2$ and magnesium-methyl-chloride are useful for preparing synthetic hydrocarbons, secondary and tertiary alcohols and fatty acids. Trichloropropane or trichlorohydrin $CH_2ClCHCl\text{-}CH_2Cl$ B.P. 158° though in itself not very useful, forms the basis of the synthesis of glycerine, a product of immense value in arts. Amylchloride and dichloropentane are useful in synthesis of amylalcohol, amylacetate and isoprene

$$\begin{matrix} CH_2 \\ CH_3 \end{matrix}\!\!-C-CH=CH_2.$$

Both amylalcohol and amylacetate are used extensively in celluloid industry, while isoprene forms the parent substance of rubber, a substance which has entered every phase of our human needs. Chloro-acetons can be used for the synthesis of citric acid or of glycerine. Monochloralkyls or hydrocarbons can be used to build up higher hydrocarbons or for the introduction of alkyl groupsin other organic compounds. Various acid chlorides like acetyl chloride or benzoyl chloride are used to make acid anhydrides or for the introduction of acetyl or benzoyl radcals.

The chlorine compounds are so vital in organic chemistry that but for their help directly or indirectly very few organic compounds could be prepared. Neither the amino group NH_2, nor the hydroxyl group OH, neither the sulphite radical, nor the sulphonic acid radical HSO_3, neither the nitro group NO_3, nor the nitrile radical CN, neither the acetyl radical CH_3CO, nor the carboxyl group COOH, neither the alkyl nor the alkoxy group, can be substituted without their mediumship. In fact, if any process is more useful, far-reaching and universal in application in organic chemistry it is chlorination. The halogens are the most intimate friends of the hydrocarbons and without their consent and co-operation no work of any kind is undertaken by the hydrocarbons themselves. If I may here be permitted to mention a personal experience in teaching, I would like to relate my experience in explaining the behaviour of various hydrocarbons in organic chemistry. To help remove the confusion of behaviour of saturated and unsaturated hydrocarbons. I had to have recourse to analogy. I compared the saturated hydrocarbons to wealthy and completely self-satisfied people, while I called the unsaturated hydrocarbons needy beggars. I further said beggars accept gifts and say "thank you," but do not give anything in return. Saturated hydrocarbons on the other hand are always ready to exchange and give something in return, if at all they need anything. They have everything and hence they are the hardest to be induced to do anything, since there is hardly any material inducement for them. The only way to make them do something for you is to approach them, not directly, but through their most intimate friends, the halogens. In that case they do anything for you.

Indirect Uses

Among the indirect uses of chlorine can be mentioned its uses as an oxidizing agent, Thus it can be used to make potassium permanganate from potassium manganate. $2\ K_2MnO_4 + Cl_2 = 2\ KMnO_4 + 2\ KCl$. It can be used in the manufacture of potassium-ferricyanide from potassium-ferro-cyanide. $2\ K_4Fe(CN)_6 + Cl_2 = 2\ K_3Fe\ (CN)_6 + 2\ K\ Cl$. A similar application can be found in making lead peroxide from litharge or lead acetate (sugar of lead): $PbO + MgO + Cl_2 = PbO_2 + MgCl_2$ or $Pb(OOCCH_3)_2 + 2\ HOCl = PbO_2 + 2\ Ch_3COOH + Cl_2$. Similarly superphosphate can be made from phosphates. $Ca_3(PO_4)_3 + 2\ SO_2Cl_2 + 4\ H_2O = 2\ CaSO_4 + Ca(H_2PO_4)_2 + 4\ HCl$. It can be used in making artificial camphor from isoborneol, which in turn can be made from turpentine or pinene. Isoborneol $C_{10}H_{17}\ OH + Cl_2 = C_{10}H_{16}O$ (Camphor) $+\ 2\ HCl$. By its use pure cellulose can be obtained from wood-pulp. Dr. Wintlein mentions an experiment whereby 100 parts by weight of dried pine-wood, treated by lime and chlorine, gives 50 parts by weight of pure cellulose. Bleaching powder can be used to produce pure oxygen gas from what is technically known as "Lavosite."

Thus it can be seen that chlorine has an extensively wide application in both inorganic and organic industries and supplies many a human want. It bleaches our linen, purifies our water, protects us from epidemic diseases and helps us in making dentistry and surgery painless. It is our companion in homes, companion in camp, companion in peace and companion in war.

The end of this war will find an enormous excess of chlorine in this country and the problem of turning this vast, otherwise nuisant material into useful channels will be before us. The electrolytic alkali manufacturers of this country will do well to think of this problem seriously, while there is time to think, and not wait until they are awakened by an impending calamity. We must remember that a stitch in time saves nine. A little foresight and forethought will go a long way in helping us to solve this problem.

Some manufacturers think that if they start anything themselves they would be competing with their present customers who are buying their chlorine. It should be remembered that a customer buys chlorine only when he can make a little money for himself. He makes only such chlorine products as have a good demand and command a good price. He is not interested to buy chlorine in order to find new uses for it, and consequently he is not the man to do research work in that line. It is the manufacturer who either lives or dies with chlorine who is the one most concerned and it is up to him to sound the depth of this unexplored region.

*Paper given at 34th meeting of Electro Chemical Society, Atlantic City.

MOJONNIER EQUIPMENT INSTALLED

In order to cope efficiently with the large amount of work involved in the control of the immense supplies of condensed milks going overseas, there has recently been installed in the laboratories of the Dominion Experimental Farms at Ottawa, a Mojonnier Tester. This piece of apparatus has been devised to determine rapidly fat and total solids in all classes of dairy products.

The principle of the method involved is identical with that of the official Roese-Gottlieb; the reagents are identical throughout. By means of high temperature electric plates and vacuum ovens combined with a centrifuge and water cooling system, the length of time required to complete a fat determination is reduced from 2½ to 3 hours with the ordinary Roese-Gottlieb, to ½ hour with this apparatus. The apparatus includes extraction flasks of such shape that the solvents can be easily and readily poured off with maximum ease, rapidity and exactness. The general arrangement of the parts has been carefully thought out with a view to convenience and rapidity of work.

The experiment of planting castor beans in the United States has proven to be a great success. It is expected that the crop to be harvested will net 2,000,000 gallons of first-grade oil. There need no longer be any danger from lack of oil, and the production of important leather substitutes should be greatly stimulated.

Mr. M. F. Fairlie has been appointed mine manager of the Mining Corporation of Canada in succession to the late Charles Watson, who was drowned in the wreck of the Princess Sophie on her voyage from the Yukon last month.

Nitrogen Fixation Furnaces*

By E. Kilbnrn Scott (Electro-Chemical Engineer)

CONCLUDED FROM NOVEMBER ISSUE

Stabilizing The Arc

For smooth electrical operation it is important to have the arc stabilized, and this is the condition which gives good yields of nitric oxid. Further, it is important to have the furnace working easily, because of the effect of an unstabilized arc on the supply circuit.

An ordinary arc lamp works well because the carbons are automatically moved so that the distance between them increases with current, to effect which an electro-mechanical device is used. This is possible because the parts to be moved are small and of light weight, but obviously the heavy metal electrodes of large electric furnaces, and the large power involved, present a much more difficult problem.

The resistance of an alternating arc varies with current in such a way that when the voltage between the electrodes decreases the current then increases. In other words the characteristic of the arc is a falling one, as shown by curve **aa** of Fig. 11. If the voltage of supply can be made to fall in accordance with the arc characteristic, then complete stability of the arc is obtained, but the only course is to specially design the alternator for a large voltage drop, as shown by curve **bb**. (The writer has used such an alternator with good effect and it is of interest to note that the largest installation in Norway, at Rjukan II, has alternators with large voltage drop, each supplying a group of three single-phase furnaces of 4,000 K.W.)

When an air nitrate factory receives energy from a transmission line so that step-down transformers are required to reduce the voltage to that required by the furnaces, then reactance may be embodied in the transformer. The transmission line itself and the various connections may also give some reactance, which goes toward reducing that necessary in the separate reactor.

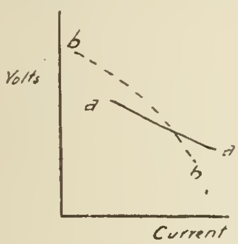


FIG. 11. Characteristics of arc and alternator.

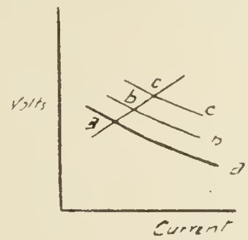


FIG. 12. Falling and rising charcateristics of electric arcs.

It is obviously desirable to design a furnace so as to work with as little reactance as possible, and one way is so to design the electrodes that they require little or no adjustment, for obviously reactance must be larger if the contingency of inexpert adjustment has to be met.

Stabilizing an arc against what may be called abnormal conditions may be done by automatically varying the force of the air in accordance with current in the arc, for increased air pressure increases the arc voltage. With varying air pressures the arc characteristic will move out parallel to itself, as shown in curves **bb** and **cc** of Fig. 12. An automatic device may be employed to do this, so giving the equivalent of a rising characteristic, as shown by curves **a**, **b** and **c**.

F. G. Lilienroth has suggested such a device, and for a Birkeland-Eyde furnace (see Fig. 13) he provides a regulating switch in the field-magnet switch, which circuit is varied by a solenoid through which the current of the electrodes passes.

Power Factor

The expanding arcs of electric furnaces give a capacity or leading-current effect, and but for the large amount of reactance used to steady the furnace the power factor would be high. With diverging electrodes the arc at the commencement of each half period is small and gradually lengthens until it breaks, so the resistance may be represented by the rising line of Fig. 14.

The low resistance causes the current at the beginning to be large as indicated by the exaggerated current wave of Fig. 14. When compared with the voltage wave the effect is as if the current were leading, and in practice such is found to be the case.

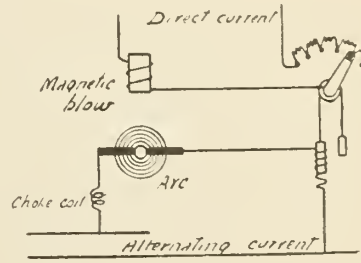
Diverging electrodes also act, with the air between, as a sort of condenser, and a feeble spark is sometimes noticed between the tips of the electrodes where they approach nearest together, which is due to the condenser action.

In the Birkeland-Eyde furnace the interaction of the magnetic field with the alternating current passing between the electrodes is also said to cause the current to lead. The power-factor is certainly higher than with the Schoenherr furnace, and this may be due to the latter having a steel tube around the long arc, which gives an inductive effect such as would be the case if armor were placed around a single conductor carrying alternating current. Dr. C. P. Steinmetz considers that the "standing arc" of the Schoenherr furnace acts in the opposite way to the expanding arcs of other furnaces, and the resistance of the arc being high at the start, causes a current wave distortion which is equivalent to a lagging current.

Reactances

Small choke coils or reactances can be made with adjustable iron cores; also the regulation of series arc lighting can be effected by an apparatus having movable coils. It would be useful to have such readily-adjustable reactances for electric furnace working, but as the power required for furnaces is very considerable, it is difficult to keep a movable core or movable coils steady enough, and probably also the core would become too hot.

FIG. 13 Devise for stabilizing the arcs of Birkelond-Eyde furnace



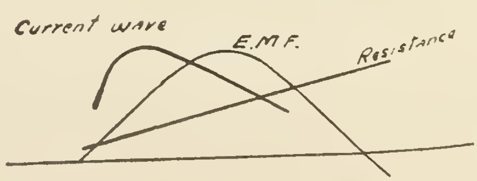


FIG. 14. Showing the effects of arcs which increase in resistance.

*Paper delivered before the 34th meeting of American Electro-Chemical Society, Atlantic City, U.S.A.

It is not possible to alter the amount of reactance by altering the number of turns of a choke coil, because the one connected to the switch contacts would act for the time being as a short circuited secondary, and very large currents would be induced that could not be safely switched off.

One way to alter reactance while the furnace is running is to change the connections of the coils from series to parallel; another is to have a number of reactances in parallel and change the number of them in circuit. This latter method is employed for the 4,000 K.W. Birkeland-Eyde furnaces. When starting such a furnace that has been re-lined, the method is to switch in only one of the three reactors, and allow only about 1,400 K.W. to pass. As the lining dries out the other reactors are switched in one after the other until the furnace receives the full 4,000 K.W.

During early experiments with a K. S. 3-phase furnace it was considered desirable to interpose transformers of one-to-one ratio between the furnace and the alternating current supply, so that in case any abnormal condition appeared, a magnetic link between the two circuits would act as a protection to the alternator. By suitably adjusting the sectional area of the core and the disposition of the coils, the magnetic leakage varied with the current and regulation was very good.

The writer understands that reactors on this principle are now used in Norway, the core being built on the lines of a Berry transformer, with groups of plates radiating from a central core round which are coils of circular shape. The magnetic forces are thus balanced, and the coils are easily kept in position.

Although many reactors are built with iron cores, there is a tendency to dispense with the iron because reactors without it are more accessible, and as the conductors are of bare copper supported in cement concrete they are fire-proof.

One form of coil known as a "toroid" has the advantage of giving the greatest amount of self-induction to the least amount of electrical resistance. It consists of bare copper strip wound concentrically into a flat coil with the turns spaced well apart and set in cement concrete.

A neat form of reactor made by the General Electric Company is shown in Fig. 15. The conductor is bare copper wire, wound in slightly conical layers, the turns of the first layer progressing from outside to inside and of the second layer from the inside to outside, and so on. The layers converge where the voltage is a minimum, the clearance between turns being about an inch (2.5 cm.) for 6,600 volts. The concrete is freed from metallic particles and cured in the presence of high pressure steam, and the whole is supported from the ground by porcelain post insulators.

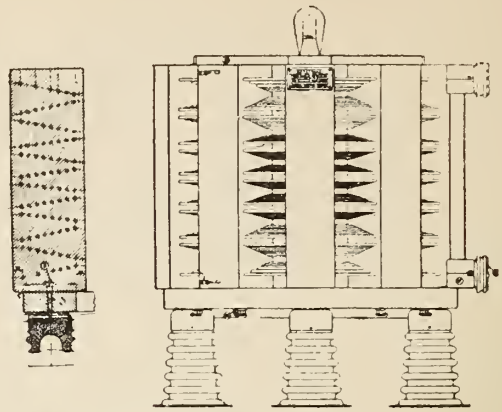


FIG. 15. Reactor made by the General Electric Co.

Air Supply

The yield of a furnace depends to some extent on the condition of the air blown through the arc, for if charged with dust particles, moisture or oil, or the acid vapors of large industrial centers, results are not so good as when the air is clean and dry. Whilst working an experimental plant in Manchester, England, it was found that the yields on moist days were lower than when the atmosphere was comparatively dry.

The air should have an easy flow from the blower to the furnace, that is to say the pipes should be short and straight as possible, and the branches of similar length, so that each furnace may receive the same pressure.

Expanding nozzles have been recommended for delivering air to the flame, but the writer has found them liable to set up throbbings in the air flow. To get even flow, the pressure at discharge has to be about half the initial pressure, and this condition is not easy to meet with air at low pressure and high velocity, because the expanding portion must be excessively long.

Air compressors of the reciprocating type are not suitable for the supply of air to nitrogen fixation furnaces, because the air must flow in an absolutely steady stream and be free from oil, etc., also such compressors are only efficient for pressures above 15 lb. per sq. in. (1 atmosphere).

Pressure blowers such as the Root type may be used, but as they also work by pocketing air and carrying it over to the delivery side, the pressure is somewhat uneven. They work efficiently with pressures up to about 8 lb. per sq. in. (0.5 atmosphere).

Fans give a steady flow, but are inefficient because they do not use the velocity energy of the air at the impeller exit. Also they are only good for pressures below 1 lb. per sq. in. (0.07 atmosphere).

Centrifugal compressors are the best type because they are efficient and deliver a steady stream of air at pressures necessary for the furnaces. They resemble a centrifugal pump in having a rapidly rotating impeller surrounded by a stationary set of discharge vanes supported by the casing. For pressures up to 4 lb. per sq. in. (0.25 atmosphere) one impeller is used, and higher pressures are obtained by merely multiplying the number of impellers. The speeds are suitable for coupling them direct either to steam turbines or 60-cycle induction motors. With 25 cycles the motor speeds are lower and gearing has to be used.

Power for Centrifugal Compressor

The amount of power required to blow the air through the furnaces depends on the pressure, but it is usually less than 3 per cent. of the energy which is supplied to the furnaces. The theoretical horse power required to compress adiabatically 100 cubic feet of air (3 cub. meters) at atmospheric pressure is given by the curve Fig. 16. It will be noted that it is a slightly rising curve.

Assuming that a 10,000 K.W. factory requires 700,000 cubic feet (20,000 cub. meters) of air per hour, or 11,600 cubic feet (333 cub. meters) per minute, then for a pressure of 5 lb. per sq. inch (0.33 atmosphere) the power is

$$\frac{11,660 \times 2}{100} = 232 \text{ theoretical horsepower.}$$

A centrifugal compressor for this duty would have two stages, and run at about 3,450 rev. per minute with an efficiency of 70 per cent., so about 400 shaft horsepower would be required.

Allowing for efficiency of the motor, about 200 K.W. would be supplied, and it will be seen that even at 5 lb. pressure the energy taken by the centrifugal blower is only about 2 per cent. of the energy put into the furnaces.

The high speed of the centrifugal compressor makes it suitable for being driven by a steam turbine, and if the turbine is supplied with steam at 120 lbs. per sq. inch (8 atmospheres)

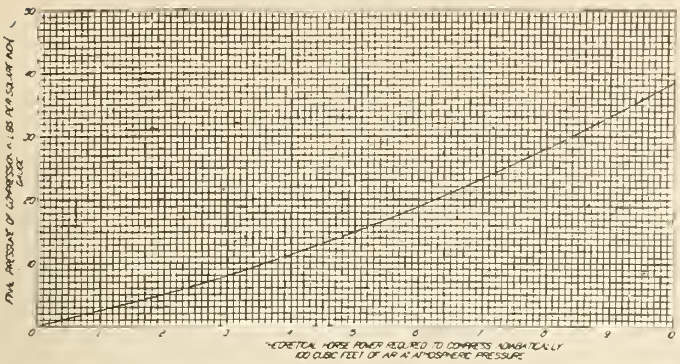


FIG. 16. Curve giving theoretical horsepower to compress air.

the consumption of steam may be assumed at about

200 x 18 = 3,600 lb. (1,630 kg.) per hour.

It is convenient to have the centrifugal compressors in duplicate, one driven by an electric motor and the other by a turbine.

Preheater

Preheating the air before it enters the furnace is advantageous because it raises the average temperature of the arc, and electrical operation is improved owing to the air being already in a partly ionized condition. With preheat the velocity of the air can also be lower than when the air is cold.

The Schoenherr furnace has a preheater combined with it, which takes the form of several annular tubes of steel around a central reaction chamber, and the entering cold air and the exit gases pass through these tubes in counter-current directions. As the gases leave the reaction chambers at over 1,000° C. it is possible to give a very high preheat to the entering air. At Saaheim, in Norway, there are 96 of these furnaces of 1,000 K.W., each one with its own preheater.

The Birkeland-Eyde furnace has also a preheater, because the air passes into the reaction chamber through a large number of small holes in the refractory chammotte lining. As the electric arc keeps this lining at red heat, the entering air is preheated somewhat before it strikes the arc. This lining constitutes one of the objections to this furnace, because it is expensive to build and takes several days to dry out.

In several ways it is an advantage to employ a separate preheater, to serve a number of furnaces, one reason being that it can be designed efficiently to give the heat exchange. Also, hot air is always available in starting a new furnace, for when a furnace has its own preheater, some time must obviously elapse before heat is available to warm up the incoming air.

It is useful to employ boilers to utilize the bulk of the heat from the furnace gases in raising steam. If the gases leave the boiler at 250°C. and a further 150°C. is absorbed in the preheater, then the preheater may be made of steel. At the same time it is advisable to have it in several units so as to take care of the expansion due to difference in temperature at the two ends. Thin steel tubes may be used, and the air should pass around them.

Effect of Adding Oxygen

By weight air consists of 23 per cent. oxygen and 77 per cent. nitrogen; or by volume 20.7 per cent. oxygen and 79.3 per cent. nitrogen. One pound at 62° F. and barometer at 30 inches occupies 13 cubic feet (1 kg.=0.81 cub. meter). One pound of oxygen at 62° F. occupies 12 cubic feet (1 kg.=0.75 cub. m.), and is contained in 56 cubic feet of air (3.5 cub. m.).

It is an advantage to add oxygen to the air passing through the furnace, because the concentration of nitric oxid is a maximum when the product of oxygen and nitrogen is also a maximum. It can be shown that it is directly proportional to the square root of the product; thus the equation for air is, 0.21 x 0.79 = 0.16. And for equal parts of oxygen and nitrogen 0.5 x 0.5 = 0.25. The increased yield is therefore 20 per cent., as shown by the ratio

$$\sqrt{16} : \sqrt{25} :: 100 : 120$$

Commercially it is only possible to add oxygen when the process is worked in a closed cycle, the amount required continuously being then only that which the nitric oxid takes up.

If we assume that a factory utilizing 10,000 K.W. requires 700,000 cubic feet of air (20,000 cub. m.) per hour then 20 per cent. of this equal to 145,000 cubic feet (4,140 cub. m.) represents the oxygen. After passing through the furnace the air contained about 1.5 per cent. nitric oxid, of which about half is oxygen.

The oxygen does not have to be pure, and if the oxygen-producing apparatus makes a mixture of 75 per cent. oxygen and 25 per cent. nitrogen, then about 1 per cent. of the 145,000 cubic feet (4,140 cub. m.), or say 1,450 cubic feet (41.4 cub. m.) per hour will have to be added continuously.

Addition of oxygen (to the air) is equivalent to increasing its pressure, for in air it occupies only one-fifth of the volume, whereas when it is equal with the nitrogen it occupies half of the volume. The effect is, therefore, the same as increasing pressure 2½ times, because much more oxygen is passed through the furnace. This is equivalent to 14.7 x 2.5=35 lb. per sq. inch (2.4 atmospheres), yet at the same time the furnace walls do not have to withstand any extra pressure.

Pure oxygen and hydrogen can be made by electrolysis, but it requires a great deal of direct current. Also pure oxygen and nitrogen can be made from liquid air, but this requires much machinery and power. In some cases, however, oxygen made by these methods is a by-product of other manufacturing processes. Thus oxygen is a by-product of plant making hydrogen for fat hardening; also it is a by-product in the manufacture of calcium cyanamid, because that process only requires pure nitrogen. Where it can be obtained such by-product oxygen should be cheap.

Hitherto the manufacture of oxygen has been practically a monopoly and in consequence prices have been kept at a high level and little improvement made in methods of manufacture. In the near future there is every possibility of oxygen being produced in larger quantitiy and much cheaper. The Jefferies-Norton process for air separation makes use of liquification and distillation, but it has new features in the method of heat exchange and in the still. In general appearance the apparatus is very similar to the Claude system, but an essential difference is that the major part of the nitrogen is not expanded but issues at its original pressure. The nitrogen is heated and then expanded in a gas engine to furnish power to drive the plant, thus no outside power is required. The heat applied to the nitrogen develops all that is necessary to drive the compressors, and for this reason the cost of the power may be neglected entirely in figuring the cost of the oxygen.

It is possible also that the centrifugal method of separating the gases of air may be made a commercial success. This takes advantage of the difference in atomic weight of oxygen and nitrogen.

Effect of Increasing Pressure

It is known that increased yields can be obtained by increasing pressure in the reaction chambers of arc furnaces, but hitherto the pressures used have been sufficient only to move the air quickly through the arc.

Extra pressure means more power to drive the centrifugal compressor, and it is a question whether a larger plant requiring more power to work it would be justified by the increased yields obtained.

In any case there is no need to use such "heroic" high pressures

as 1,500-2,000 lb. per square inch (100-135 atmospheres) which are necessary for the Haber process of making synthetic ammonia. Such pressures can be dealt with on laboratory scale, with small tubes and apparatus, but they are troublesome on a large scale, especially as it is difficult to retain hydrogen and to prevent it forming an explosive mixture with oxygen.

Air at high pressure has a greater insulating value than air at low pressure, as shown by the fact that sparking between the metal quadrants of an electrostatic voltmeter may be stopped by merely increasing the air pressure. Owing to lower pressure at high altitudes the corona effect on transmission lines is also more pronounced.

It should be noted that a small pressure is caused by the explosions from the arcs in the furnace. When a furnace is first started up, these are very pronounced and of varying intensities, but after the furnace is heated up the explosions become less intense and more numerous.

Absorption

Fig. 17 is a diagram indicating the approximate temperature of the gases as they pass through the system, when it is desired to make nitric acid. Boilers reduce the temperature from about 1,000° C. to about 250° C., and a heat exchanger then reduces them to about 100°. Finally a water cooler brings them down to 40° C. or lower, the final temperature obviously depending on the temperature of the cooling water, it would probably be possible in winter to reduce the temperature to about 20° C. The lower the temperature of the gases in the absorption towers, the better is the absorption, and that is the reason why stronger acid is obtained in winter than in summer.

As the gases leave the furnace they are at high temperature and must be carried in ducts lined with firebrick. Between 250° C. and 100° C. steel may be used, but below 100° C. aluminum or acid-proof stoneware or silicon-iron cannot be used. The water cooler should also have aluminum pipes.

Before the gas enters the towers it is necessary to facilitate the oxidation of all the nitric oxid to nitrogen dioxid, and for this purpose large open spaces are necessary through which the gases can flow sluggishly.

It is of some assistance to have connecting pipes of large cross-section. At Rjukan II, Norway, the furnaces are about 3,000 feet (0.9 kilometer) from the absorption towers and the gases are carried through an aluminum pipe about 3 ft. (0.9 m.) diameter. The gases enter the pipe at about 200° C., and are cooled down considerably while passing through it.

With gases at 40° C. and 1.5 per cent. nitric acid concentration, the nitric acid can be easily made to about 33 per cent., which is correct strength for a manufacture of ammonium nitrate and calcium nitrate.

When sodium nitrate is required, the gases must enter the absorption towers at about 250° C., because at this temperature only about half the nitric oxid has been changed to nitrogen dioxid and this mixture when absorbed by sodium carbonate or caustic soda gives sodium nitrite without any nitrate. For this product the absorption towers can be much smaller than those for making nitric acid, and they are also cheaper because they can be made of steel plate instead of acid-proof brickwork. Considerable quantities of sodium nitrite are required for the aniline dye industry, and it is also used for drugs, pickling meat, etc.

Cooling the Gas

The chemical reaction of nitrogen and oxygen is reversible, but the tendency for nitric oxid gas to dissociate is only slight at below 1,500° C. The problem is therefore to jerk the nitric oxid from arc temperature to below 1,500° C. To a certain extent this is performed automatically by the air which surrounds the arc streamers, and it is probably most effective just at the moment when the arc breaks. Passing the air at high velocity through the flame is also advantageous, and at the same time the fixed

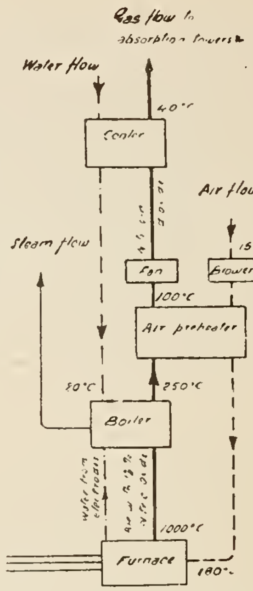


FIG 17. Showing flow of gas and air and approximate temperatures.

gas and air should be withdrawn from the top of the furnace by an exhaust fan.

Several ways have been employed for expediting the cooling for example, in the Pauling type of furnace some of the cooled gases are re-introduced again at a point just above the zone of maximum temperature.

Another method is to impinge the top of the arc flame onto a cooler, which may take the form of a steam boiler. During experiments with an early model of the K.S. 3-phase furnace, a boiler was set low enough for the electric arc flames to play against the tubes, when it was noted that they flickered about the surface much the same as do the flames of ordinary coal gas, and the boiler was not detrimentally affected. This plan takes advantage of the latent heat of steam, and the cooling is just as good in a large furnace as a small one. The boiler or cooler is connected to earth, but as the centre of the flame is the neutral point of the 3-phase system no current passes, as the phases are in balance. As a matter of fact, the bulk of the electrical energy delivered to a furnace passes between the electrodes near the bottom of the flame.

Steam from Boilers

The most economical way to cool furnace gases is to pass them through boilers and to employ the steam so produced for various purposes in the factory, such as evaporating water for the end products, etc.; also, as indicated below, the steam may be used to generate electric energy and so work regeneratively.

In order to show how much steam can be raised by the heat of furnace gases, it may be of interest to give some figures for a plant equipped with furnaces to utilize 10,000 K.W. and supplied with about 700,000 cubic feet of air (20,100 cub. m.) per hour.

At atmospheric pressure, the volume of air containing 1.5 per cent. of nitric oxid gas would be about 12.5 cubic feet per pound, and therefore 700,000 cubic feet (20,000 cub. m.) will weigh

$$\frac{700,000}{12.5} = 56,000 \text{ lb } (2,550 \text{ kg.}).$$

Assuming that the air and nitric oxid enter the boiler at about 1,000° C. (1,800° F.) and leave at 250° C. (450° F.) then the difference of temperature is 750° C. (1,350° F.).

The specific heat of air is about 0.24 so the total heat in B. T. U. will be

$$1,350 \times 0.25 \times 56,000 = 18,000,000 \ (4,500,000 \text{ cal.}).$$

Assuming that about 970 B. T. U. are required to evaporate a pound of water into a pound of steam at atmospheric pressure,

the steam will amount to

$$\frac{18,000,000}{970} = 18,500 \text{ lb. per hour (840 kg.).}$$

Allowing for loss by radiation through the brickwork setting and the steam drum, the total steam may be assumed at 18,000 lb. (820 kg.) per hour.

Steam at 125 per sq. inch (8.5 atmospheres) is suitable for evaporating purposes, and if the steam has to be carried some distance it is well to add about 50° F. of superheat, making a total temperature of about

$$350 + 50 = 400° \text{ F. } (200° \text{ C.}).$$

In a very large installation, more steam may be generated than is required for evaporation of end products, and in that case it can be used for generating electric energy. In the latest installation at Rjukan II, in Norway, there are three 4,000 K.W. steam turbine alternators, supplied with steam by the hot furnace gases.

It is very significant that in an installation having practically unlimited water power, steam turbines should have been installed, and indicates the saving there would be by combining an air nitrate factory with a steam power house.

If all the steam from a 10,000 K.W. plant was to be used in turbo generators having a steam consumption of say 18 lb. (8.2 kg.) per K.W. hour, then the energy would be

$$\frac{18,000}{18} = 1,000 \text{ K.W.}$$

That is to say, about 10 per cent. of the energy put into the furnaces can be regenerated.

The boilers may be of any pattern so long as they are gas tight, and they may form part of the furnace, or be separate, as in Norwegian installations. The feed water should be hot so that moisture may not be deposited on the tubes, and for this purpose the water from the cooling electrodes can be used, thus giving a further saving of heat.

Theory of the Reaction

In many discussions on the subject of nitrogen fixation in arc furnaces it has been assumed that the sole factor bringing about formation of nitric oxid is a thermal one. This is very doubtful, however, because all data relating to the laws of thermo-dynamic equilibrium have been obtained at temperatures very much lower than those commonly met with in electric furnaces; therefore it does not follow that the same laws hold good for electric furnaces.

Dr. Maxted states, in the proceedings of the Society of Chemical Industry for April 15, 1918, that:

"Purely thermic interpretation of the nitrogen oxid reaction depends on a large extrapolation from lower to higher temperatures, and assumes that no latent factors cause increase or decrease in the observed temperature co-efficients."

Some experiments by Mr. J. L. R. Hayden (see Trans. A. I. E. E., 34, 613) lead him to the conclusion that in fixing nitrogen by the electric arc the conditions of thermo-dynamic equilibrium are of secondary, if of any, moment. In other words, the process is essentially an electric one.

His experiments were made with electrodes of various material which gave different temperatures, and the order of their nitric acid production was as follows:

Concentration	Boiling Point (Arc Temperature)
Iron—Highest	2450° C.
Titanium	2700° C.
Carbon	3600° C.
Copper—Lowest	2310° C.

It will be seen that although carbon gives the highest arc temperature it is relatively inefficient in producing nitric acid. Also the iron and copper which give approximately the same arc temperature are at opposite ends of the scale in producing oxid.

Another experiment made with the mercury arc, which has a much lower temperature than the above, showed that it was easily possible to get concentrations above those representing thermo-dynamic equilibrium. In electric furnaces there are other phenomena besides that of heat, for example, ionization, which appears to have the effect of disrupting the nitrogen molecules and so facilitating their combination with surrounding oxygen. It is conceivable also that the electric stress due to the high voltage and the magnetic field set up by the currents may have some effect.

Mr. Cramp, of Manchester, found that there was an increase of nitric oxid when ozone was added to the air passing into the arc flame, and it may be that O_3 and the corresponding polymer of nitrogen, which Sir J. J. Thompson calls N_3, are formed momentarily, and then, dissociating, the nascent atoms of oxygen and nitrogen combine.

MACHINE-MADE EMULSIONS

Every little while we hear of a new and wider application being made of an old process in the industrial realm. One of the latest in this connection is that shown by Process Engineers, Inc. (501 Fifth Ave., New York, and formerly of Montreal) at the recent National Exposition of Chemical Industries in New York, where they exhibited a process for making oil emulsions by machinery instead of by the usual hand method. They had purchased the process from interests in Germany, about five years ago, and have since had great success with its introduction in the paper industry in Canada and the United States.

In the old methods of making oil emulsions by hand or agitating apparatus, the great drawback was the inability to obtain a perfect dilution of the compounds, but by this mechanical device, operated under exact conditions of temperature and pressure, the difficulty is entirely overcome and practically no decomposition occurs. At the exhibit two containers were shown, each holding an oil emulsion—one made by hand, the other by the new process. The former showed imperfect mixture, there remaining on the surface a layer of pure oil, while in the latter no trace of oil was visible, although the mixture had been standing for several days.

For the past ten or twelve years, these oil emulsions have been used exclusively for the paper industry, but Process Engineers have demonstrated the great value of the emulsions in machinery, and other industries. The employment of emulsion lubrication for high speed cutting tools is being extensively adopted, and such lubrication is found to be the very best. Mineral oil was formerly used, and is still to a certain extent for cutting tools, but does not give nearly such satisfactory results as a properly made emulsion. The advantages of the latter are found in the fact that it keeps the tool cool, reduces the friction and covers the finished material with a film of oil which acts as a protection and prevents rust or corrosion.

Many industrial plants to-day are being operated with losses in lubrication, because better methods of operation have not been known, and it is the purpose of Process Engineers to supply the deficiency. They are already making installations in plants that want maximum efficiency in the use of their materials. Our manufacturers are not slow to adopt the use of any new methods when the results can be clearly proven to be of value.

Mr. J. A. DeCew, president of Process Engineers, was present at the Exposition, and demonstrated the importance of proper oil emulsions over other types, and from his statements it was obvious that the use of this method of lubrication is only in its infancy.

We are sorry to note that a recent despatch from France brings word of the death from influenza of Lieut. W. Argo. Dr. Argo was attached to the Chemical Warfare Service Section of the United States Army. He was a Canadian, and a graduate of the University of Toronto. For the last five years he has been attached to the Department of Chemistry, University of California, as lecturer in chemistry.

The Utilization of Nitre Cake in the Manufacture of Superphosphate*

By Frank T. Shutt, M.A., D. Sc., and L. E. Wright, B. Sc.

Notwithstanding the advances that have been made of late years in the utilization of chemical by-products, nitre cake—essentially sodium bisulphate the residue from the manufacture of nitric acid from Chili saltpetre—must be regarded as a waste product and practically valueless. Many uses have been proposed for it, but only a few of these have proved profitable or of any commercial importance. The literature on the subject is voluminous, and we find on record the results of a very large amount of investigatory work of the very highest order, but apparently the problem still awaits a successful issue. Even in peace times this by-product has accumulated and proved an expensive nuisance; in these days when it is being produced in millions of tons its disposal has become a very serious matter. Where location permits it to be discharged into tidal waters, it is most cheaply and possibly least objectionably got rid of, but inland its disposal means, generally, the pollution of streams and lakes and the destruction of fish or the ruination of land. It is evident that a fortune awaits the one who can find a profitable use for it in large quantities.

Of the almost innumerable processes that have been brought out or suggested it would be quite impossible in this paper to give any account, but a few of the uses that nitre cake has been put to may be enumerated, for the purpose of showing the wide range of investigational activity in this matter; the production of hydrochloric acid and salt cake by furnacing with salt; the pickling of metals; the extraction of grease from wool; the bleaching of lace, etc.; mineral water manufacture; the manufacture of crude ferric sulphate for sewage precipitation; the preparation of sodium sulphide; the separation into Glauber's salt and free acid and lastly, though by no means is the list exhausted, as a diluent for sulphuric acid in the manufacture of superphosphate. It is in connection with this latter use, though not employing sulphuric acid, that the work recorded in this paper was undertaken.

This preliminary investigation was taken in hand at the instance of the Metallurgical Division, Explosives Department, Imperial Munitions Board, which was anxious to find some useful purpose for the large amount (about 150 tons daily) of nitre cake produced at the munitions plant at Trenton, Ont. This nitre cake is stated "to contain 30 per cent free sulphuric acid, nitre acid not over .2 per cent and small amounts of iron. Otherwise it is practically free from impurities." The supplies of nitre cake (Trenton), Florida, Pebble Rock and Canadian Apatite used in this experimental work were furnished by the Director of Explosives.

In the preparation of the materials the nitre cake was reduced in an iron mortar until sufficiently fine to pass through a 60 mesh sieve. No particular difficulty was experienced in this operation. Reduction of the cake in a pebble or ball mill was tried, but this was found to be unsatisfactory, owing to the material adhering to the pebbles. Both the Florida Pebble Phosphate and the Canadian Apatite readily reduced in the pebble mill, screen tests showing that for the former 98 per cent passed the 80 mesh and 78 per cent a 100 mesh sieve and for the latter the ground product 100 per cent passed the 100 mesh sieve.

After certain preliminary experiments it was decided to ascertain the action of the nitre cake on the phosphates when (1) the materials were mixed "dry" and (2) on the materials made into a paste with the addition of a little water.

In the "dry mix" the powdered substances were weighed out in the several proportions stated in the tables of analysis, thoroughly mixed, and placed in glass stoppered bottles. The product or "mix," after being allowed to remain at room temperatures, was analysed at the end of one week. The product was a fine flour-like material, with no evidence of caking.

Analyses of "dry" mixes that had been allowed to stand two weeks gave results practically identical with those of one week's standing.

In the wet "mix", to the materials mixed in the proportions noted, a small but known weight of water was added and the whole stirred to a damp mass. This was placed in stoppered bottles and allowed to stand 48 hours. The mass was then emptied out and allowed to air-dry. Although a slight caking or hardening took place, it was very readily broken down to a fine powder. The setting or hardening was more pronounced with the Canadian Apatite than with the Florida phosphate, but in both cases a first class product, as regards its mechanical condition, was obtained.

An outline of the analytical procedure may be given as follows: 2 grams of the mix were weighed into a beaker and 200 cc of water added. After occasional stirrings for 2 hours the whole was filtered and the filtrate made up to 500 cc and an aliquot taken for the determination of water-soluble phosphoric acid. The filter with its residue was then placed in a bottle with 500 cc of a 1 per cent solution of citric acid and shaken for 5 hours in a mechanical shaker and filtered. The phosphoric acid as determined in the filtrate is denoted in the tables of analyses as "1 per cent citric-soluble." Determinations of the water-soluble and ammonium citrate soluble phosphoric acid were also made according to the official methods of the

Using Florida Pebble Phosphate TABLE I

	Available Phosphoric Acid						Total P_2O_5 in Mix	Percentage of Total P_2O_5 Rendered Available	
(a) Dry Mix Proportions	Water Soluble	1% Citric Soluble	Total H_2O & 1% Citric	Water Sol. A.O.A.C. Method	Citrate Sol. A.O.A.C. Method	Total A.O.A.C. Method		H_2O & 1% Citric	A.O.A.C.
2½ N.C. : 1 F.P.P.	7.15	2.17	9.32	5.30	0.76	6.06	9.32	100.00	65.0
2 N.C. : 1 F.P.P.	7.28	3.70	10.89	5.04	0.94	5.98	10.80	100.00	55.4
1 N.C. : 1 F.P.P.	6.83	8.94	15.77	6.00	0.81	6.81	16.15	97.6	42.2
0.5 N.C. : 1 F.P.P.	5.04	10.34	15.38	5.30	1.92	7.22	21.54	71.4	33.5
(b) Wet Mix Proportions									
6 N.C. : 3 F.P.P. : 1 H_2O	7.57	2.94	10.51	6.83	0.64	7.47	10.47	100.00	71.3
3 N.C. : 3 F.P.P. : 1 H_2O	7.31	5.04	12.35	7.79	1.08	8.87	15.61	79.1	56.8
6 N.C. : 6 F.P.P. : 1 H_2O	7.66	8.43	16.09	7.85	1.41	9.26	16.00	100.00	57.9

Using Canadian Apatite

TABLE II

(a) DRY MIX Proportions	Available Phosphoric Acid: Water Soluble	1% Citric Soluble	Total H_2O & 1% Citric	Water Sol. A.O.A.C. Method	Citrate Sol. A.O.A.C. Method	Total A.O.A.C. Method	Total P_2O_5 in Mix	Percentage of Total P_2O_5 Rendered Available: H_2O & 1% Citric	A.O.A.C.
3 N.C. : 1 C.A.	3.64	3.00	6.64	3.00	0.00	3.00	9.85	67.42	30.5
2 N.C. : 1 C.A.	4.34	3.83	8.17	3.64	0.00	3.64	13.13	62.22	27.7
1 N.C. : 1 C.A.	3.96	4.47	8.43	4.21	0.16	4.37	19.70	42.79	22.18
0.5 N.C. : 1 C.A.	2.94	5.24	8.18	3.32	0.45	3.77	26.27	31.15	14.4
(b) WET MIX Proportions									
6 N.C. : 3 C.A. : 1 H_2O	6.14	2.23	8.87	7.85	0.58	8.43	12.31	72.06	68.5
6 N.C. : 6 C.A. : 1 H_2O	6.26	3.64	9.90	6.15	0.57	7.02	18.88	52.43	37.17

Association of Official Agricultural Chemists, generally adopted on the American continent in the official analysis of fertilizers.

The composition of the Florida Pebble Phosphate and the Canadian Apatite used in the experiments is as follows:

Analysis of Florida Pebble Phosphate and Canadian Apatite

	Flor. Peb. Phos.	Can. Apatite
Total Phosphoric acid	32.30	39.40
equiv. to tricalcic phosphate	72.54	86.05
One per cent citric sol. phos. acid	11.50	6.06
equiv. to tricalcic phosphate	25.10	13.24
Citrate sol. phos. acid, A.O.A.C.	1.91	nil
equiv. to tricalcic phosphate	4.17	nil
Water-soluble phosphoric acid	nil	nil

Discussion of Results

Tables I and II set forth clearly the results obtained in this investigation and will need but little explanatory text. The percentages of phosphoric acid rendered available in the several mixes, as determined by treatment with water and 1 per cent citric acid solution and by the A. O. A. C. methods, are stated and the percentages of the total phosphoric acid in the mixes so converted are also given. Certain of the more important results may be briefly emphasized as follows:

Table I—Florida Pebble Phosphate

Dry Mix:—The highest percentage of available phosphoric acid, as obtained by using water and 1 per cent citric acid solution as solvent, resulted from the 1 to 1 mixture. This product contained 15.77 per cent, of which 6.83 per cent was soluble in water. This indicates that of the total phosphoric acid in the mix, 97.6 per cent had been converted into more or less available form. This is closely followed by the mix, 0.5 nitre cake to 1 F. P. Phosphate, which by the same analytical method is seen to contain 15.38 per cent of available phosphoric acid. Since the percentage of total phosphoric acid in this latter mix is greater than in the 1 to 1 mix, the percentage rendered available is less, viz.: 71.4 per cent.

Considering the results obtained by the A. O. A .C. methods, it will be observed that, while the percentages of water-soluble phosphoric acid do not differ greatly from the water-soluble data just discussed, the percentages of "citrate-soluble" are very much less than when 1 per cent citric acid solution is used. This markedly reduces the total percentages of available phosphoric acid, as compared with the results when employing the citric acid solution. In the mix 1 to 1, the total available phosphoric acid is 6.81 per cent, of which 6.00 per cent is soluble in water.

Wet Mix:—Three series were experimented with, the proportions being:

(a)	6 N.C.	:	3 F. P. P.	:	1 H_2O
(b)	3 N.C.	:	3 F. P. P.	:	1 H_2O
(c)	6 N.C.	:	6 F. P. P.	:	1 H_2O

The percentage of water-soluble phosphoric acid in all three series was practically the same by both methods, but as in the case of the dry mix the citric soluble percentages are much higher than those obtained by the A. O. A. C. citrate-soluble method.

The best results were obtained with proportions of series (c), (6 N. C.: 6 F.P.P.: 1 H_2O) which gave a product containing 16.09 per cent available phosphoric acid (of which 7.66 per cent was water soluble), as determined by 1 per cent citric acid solvent. Since the total phosphoric acid in the mix is 16.0 per cent, it is evident that the conversion is very satisfactory. Similarly in series (a) 100 per cent conversion was brought about, but the product contains a lower percentage of available phosphoric acid (10.51), corresponding to the lower percentage of total phosphoric acid in the original mix.

By the A. O. A. C. methods, series (c) similarly possessed the highest percentage of available phosphoric acid, viz.: 9.26, which stated otherwise means that practically 60 per cent of the total phosphoric acid in the mix had been rendered available.

Table II—Canadian Apatite

Dry Mix:—It will be first evident that the degree of conversion is decidedly lower than in the similar series using Florida Pebble Phosphate, indicating the harder and more resistant nature of the Canadian Apatite.

The series in which the proportions were 1 N.C. to 1 C.A. proved, as in the case of the Florida Pebble Phosphate, the most successful. Its product contained 8.43 per cent available phosphoric acid (of which 3.96 per cent was water soluble), as determined by 1 per cent citric acid method. This is equivalent, practically, to a 43 per cent conversion. By the A.O.-A.C. methods the available phosphoric acid was 4.37 per cent (practically entirely water-soluble), or, expressed otherwise, a 23 per cent conversion.

Wet Mix:—The results generally as regards the total available phosphoric acid in the several mixes, and hence in the degree of conversion, are considerably higher than in the corresponding dry mixes. In the series 6 N.C.: 6 C.A.: 1 H_2O the total available phosphoric acid is 9.90 per cent by the 1 per cent citric acid method and 7.02 per cent by the A.O.-A.C. methods. This, respectively, is equivalent to 52 per cent and 37 per cent conversion of the total phosphoric acid in the mix.

Unfortunately more pressing work necessitated at this stage the postponement of further prosecution of this investigation.

As opportunity permits the work will be proceeded with, laboratory experiments being supplemented by trials on a larger scale, to simulate more closely the results that would be obtained in the factory. Though of a preliminary and incomplete nature, the results here presented appear to justify the conclusion that the waste product nitre cake could be used advantageously in the manufacture of a superphosphate containing 7 per cent to 9 per cent available phosphoric acid (A.O.A.C.) employing either Florida Pebble Phosphate or Canadian Apatite, the only apparatus required being the grinding machinery for reducing the materials.

Summary

1. Employing finely ground Florida Pebble Phosphate (total P_2O_5, 32.3%) a dry mix of 1 N.C., to 1 F.P.P., yielded a superphosphate containing 15.77 per cent available phosphoric acid as determined by 1 per cent citric acid method or 6.81 per cent by the A.O.A.C. methods. The wet mix 6 N.C. : 6 F.P.P. : 1 H_2O gave 16.09 per cent and 9.26 per cent available phosphoric acid, respectively, by the two methods of analysis.

2. Canadian Apatite (total P_2O_5, 39.40 per cent) is less readily acted upon by the nitre cake than Florida Pebble Phosphate, the products of the several mixes showing lower percentages of available phosphoric acid than the corresponding mixes with the latter phosphate.

The dry mix 1 N.C. to 1 C.A. gave a product containing 8.43 per cent and 4.37 per cent, available phosphoric acid, respectively, by the 1 per cent citric acid method and the A.O.A.C. methods. The wet mix product from 6 N.C.: 6 C.A.: 1 H_2O, contained 9.90 per cent and 7.02 per cent available phosphoric acid respectively by the two methods of analysis employed. While in the case of the Florida Pebble Phosphate no very marked increase in the percentage of available phosphoric acid resulted from mixing the materials wet and allowing them to stand, the wet mixes, using Canadian Apatite, were decidedly richer than the corresponding dry mixes in this constituent.

*Summary of Paper read before Chemical and Physical Section, Royal Society of Canada. May, 1918.

CANADA'S MUNITION RECORD

The quantities of materials of all kinds made in Canada for war purposes greatly exceeds the average conception. In the manufacture of shells alone, we had literally hundreds of plants running in a remarkably efficient way compared with larger plants elsewhere. Their united output will stand very favourable comparison with the grand total for America. Considering British and Canadian production of munitions together, it is estimated that Canada produced one quarter of the total nitric acid output for the six months' period ending last September, the plant at Trenton being the second largest producer. In T.N.T. Canada produced 10 per cent. of the total British and Canadian output. British Acetones, Ltd., Toronto, although now shut down, were among the largest producers of this particular product. Canada produced 48 per cent. of the total pyrocotton turned out by British factories. Although these figures are not final, they must be fairly accurate and all go to show that Canada at home has held her end as well as the boys overseas.

PERSONAL

The notice in our November issue referring to injuries received by Dr. H. L. Stewart was incorrect, inasmuch as Dr. Stewart is Professor of Philosophy instead of Chemistry, and is stationed at Windsor, N.S., not Halifax, N.S. Dr. Eben MacKay, the Professor of Chemistry in Dalhousie, and the energetic President of the Maritime Chemists' Association, has not met with any accident.

THE FUTURE OF ELECTROLYTIC CHLORINE*

By A. H. Hooker

Not until well after this war was started and we were able to grasp the magnitude of the operations in Europe, were we impressed with the plodding thoroughness with which Germany had developed her chemical industry as a preparation for war. Her dye industry with its fundamental acid and nitration plants was but a camouflage powder plant, and a training school for makers of explosives. Her intensive adaptation and work on the fixation of nitrogen, so ably started by Bradley, of Niagara Falls, was subsidized and carried forward by German capital, using cheap Norwegian water power to prepare an industry that might at any time be transferred to German soil and supply Germany internally with the necessary nitrates for explosives.

Eventualities have shown the wisdom of developing these chemical and electro-chemical industries as measures of preparedness for a country that wishes to be self-sufficient in the event of war. The United States is now building huge plants for the fixation of nitrogen and the manufacture of nitrates; plants which we expect to stand as bulwarks of defence in case of necessity, and which we expect to operate and maintain as efficient units, by the production of fertilizers and chemicals. Germany, treating the conventions as a scrap of paper, to the horror of the world, introduced poison gas as a most potent factor in the war. There could be but one answer; to meet gas with gas, equally deadly, handled as efficiently and in larger quantities.

We now naturally face the question, "What is the future of electrolytic chlorine?" since England, France, Italy and Japan, to say nothing of Germany, have all increased their chlorine output during the war.

It should be borne in mind that a chlorine producing plant, to be maintained in any degree of operating efficiency, must operate continuously, twenty-four hours a day, three hundred and sixty-five and one-quarter days in the year. This makes it particularly desirable to operate in connection with the uniform water-power, but also requires a constant and not a fluctuating market. While the electrolytic decomposition of salt produces two products, chlorine and caustic soda, it should be kept in mind that the heavy investment cost of such a plant and the necessity for constant operation make the chlorine the primary object of the operation and the caustic soda the secondary product. Therefore, the permanent use to which chlorine is put must be such that the chlorine can bear the burden of this operation. This is well illustrated by a review of the past history of the chlorine industry.

In England, a past generation saw a great chemical industry built up around the Le Blanc process, soda plants of the United Alkali Company. The output of these plants grew until they supplied the markets of the world with soda ash and caustic soda produced by the decomposition of salt with sulphuric acid. The chlorine released in the form of hydrochloric acid more than flooded the English acid market and was at first allowed to escape from the chimneys until the vegetation was killed for miles around. A halt was called and it was allowed to flow into the rivers and dumped into the sea until the destruction of fish called for other disposition. Chlorine, at this time, was worse than a by-product; it was an expense and a nightmare to the producers.

The Mond and Deacon processes were evolved for converting this waste acid into a new article of commerce, "chloride of lime" or bleaching powder. The main consideration was to get rid of this chlorine at a price that would pay for the lime, packages and labor involved in disposing of it. Truly, at this time, chlorine and hydrochloric acid were by-products and a drug on the market.

With the advent of bleaching powder, several new industries were built up; plants were constructed and expanded for the

bleaching of textiles and paper, using this new type bleaching material as a fundamental chemical. The consumption spread to other countries, grew in volume and demanded increased production. The United States became one of these important markets.

At that time, the price received for soda ash by our present standards was very high; the price for bleach very low. The net result, however, was a real profit to the United Alkali Company.

Then came the advent of the Solvay Process for making soda ash cheaply and with the chlorine combined harmlessly as calcium chloride.

The merry war was on. The price received for soda ash and caustic soda was cut to a point where the LeBlanc plants suffered serious financial losses and began closing down, while the Solvay plants grew in importance and number and were in a fair way to supply the needs of the world at new prices.

Then came another factor. The paper and textile industries which had developed to large proportions through the use of the despised by-product, chlorine, found themselves without bleach, since this was not supplied by the Solvay process. The result was a demand for chlorine at any price to keep their plant going. The net result was that the LeBlanc plants were again started up to a sufficient extent to meet the high-priced demand for chlorine in the form of bleach and hydrochloric acid with their soda ash and caustic soda sold at a price fixed by the competition of the Solvay process. Thus the market for chlorine at a profitable price became the mainstay as well as the limiting factor as to the output which could be produced economically by LeBlanc plants.

About the time a balance between the LeBlanc and Solvay processes was reached, there came a new development, the electrolytic process for the production of caustic soda and chlorine.

The chlorine industry of the United States has developed entirely along electrolytic lines and has always been limited to the demand for chlorine at a profitable price—it bids fair to remain so limited for the future.

The old uses for chlorine are well developed and can sustain a living price for a limited production of chlorine.

What is really needed is new uses for chlorine, against which the chlorine can be charged at a fair operating price.

In the organic field we have synthetic indigo, sulphur colors, picric acid, benzoic acid, etc., all pointing to a gradually increasing consumption of chlorine in a field but hardly touched as yet.

The use of aluminum chloride for the cracking of petroleum oils opens another field.

The use of chlorine in the treatment of ores bids fair to effect a great saving of metal values, and bring about a number of radical changes from established metallurgy where we can look with confidence for the largest tonnage use of chlorine.

Our Research Departments and Universities should give every encouragement to a larger development of our permanent chlorine industry, since the maintenance of these chlorine-producing plants with a constant market is as important to the Government as the maintenance of reserve plants for the manufacture of sulphuric acid, the fixation of nitrogen, or any other basic munitions.

Rather a vivid picture sometimes presents itself to me these days when I recall in the early months of 1914, standing beside Herr Geheimrat Professor Duisberg in the furnace room of one of the largest German Chemical Works on the Rhine. Surrounding me was a large group of American wedge furnaces fed by the latest American ore-handling equipment, all introduced to save man-power. He pointed out with pride, to the largest sulphuric and nitric acid plant in the world and said that the entire output was consumed within the plant producing pharmaceuticals, dyes and photographic chemicals, to be distributed at high prices to the markets of the world; that their chief raw materials were pyrites from Spain, saltpetre from Chili, coal tar crudes from the coke ovens of Belgium, salt and coal from Germany. We visited a new liquid air unit just being erected, which I was told would, during the summer, supply the nitrogen to combine with hydrogen from the electrolytic chlorine plant to cut down, in part, their dependence on foreign nitrate. For days I devoted myself to perfecting them in the use of our larger and more efficient American Townsend Cells for the production of chlorine—chlorine which they were using in part to chlorinate benzol received from Belgium and convert it into monochlorbenzol and in part to liquify and pass on to other departments.

Much as we detest the Germans for introducing the barbarous weapon of poison gas into this war, it so nearly accomplished their ends on several occasions and has met with such wide use and proved such a powerful weapon that it must always be reckoned with in the future.

In considering united action for the prevention of future wars, due consideration must be given to gas warfare and the control of chlorine supplies which form the base of most of these gases.

It seems to me that President Wilson has clearly pointed the way to action on the matter of chlorine which will meet the hearty approval of all.

He says: "Fourth, and more specifically, there can be no special selfish economic combinations within the league and no employment of any form of economic boycott or exclusion except as the power of economic penalty by exclusion from the markets of the world may be vested in the League of Nations itself as a means of discipline and control."

When the terms of peace are decided upon, what more fitting than that one of these conditions, Germany not as a matter of economic boycott, but as a matter of discipline and control, should be compelled to dismantle all of her chlorine plants and receive her supplies from the outlying plants of England, France and Italy. Should this not suffice, some of her equipment could be removed and used to rehabilitate Belgium, chlorinating on the spot the benzol formerly sent to Germany.

*Address before American Electro-Chemical Society, Atlantic City October 1st, 1918

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

A meeting of the Toronto Section of the American Institute of Electrical Engineers was held Nov. 22nd and 23rd, fully 150 members being in attendance. On the second day visits were paid to the plants of the British Forgings Co., the Hydro-Electric Commission's electrical laboratories and the Leaside Munition Works. The papers presented were a sketch of the electric power developments of Ontario by Arthur H. Hull, an account of the Canadian Northern Railway tunnel under Mount Royal, by W. G. Gordon, and a description of the transmission line over the St. Lawrence River, by S. Svenningson, the designing engineer of the Shawinigan Water and Power Co. by whom the line was built. This work is unique in two points. One is that the span, 4,800 feet, is the longest in the world, and that the voltage at which the current is transmitted—that is, 110,000 volts—is the highest of any line yet constructed.

ADVISORY BOARD ON NATURAL GAS

Hon. G. Howard Ferguson, Minister of Lands, Mines and Forests of Ontario, announces that an Advisory Board will be appointed to deal with the natural gas problem of the province. The apportionment of the supply of natural gas between the industries and the domestic consumers has been a vexatious matter for months past, and if the proposed Board has the right leaven of technical and industrial knowledge, it will render valuable service. At present the control of the natural gas supply is under the Ontario Railway Board, but the relations between the two bodies will be determined next session.

Canada and Electro Chemistry

By Francis A. J. Fitzgerald, A.I.E.E., Niagara Falls, N.Y.

III.—A Hydro Electric Experiment

(Concluded from November Issue)

So far as certain aspects are concerned the Canadian people have shown more common sense in their attitude towards the development of Niagara Falls power than have the people of the United States. The extraordinary propaganda carried on for several years in the United States for the purpose of preventing the use of Niagara Falls as a source of electrical energy never seems to have met a very enthusiastic reception in Canada. In the Province of Ontario, however, another propaganda has met with remarkable success—the state ownership of hydro electric systems. The popularity of this scheme is so great that the Ontario Hydro Electric Commission has been created and in all probability will eventually monopolize more or less completely the hydro electric systems in Ontario. This daring experiment is one in which the electro-chemist is vitally interested, for it is obvious that the progress of electro-chemical industry in Canada is closely bound up with the future of the state-owned hydro electric systems. There has, of course, been strong opposition to this state ownership of water powers not alone from those directly interested in private ownership as the advocates of the Hydro Electric Commission would have us suppose, but from many disinterested persons who recognize the grave dangers inevitably involved in the experiment. It appears, however, that owing to the strong popular support of the Hydro Electric Commission, the experiment will be fully carried out. Therefore, it seems wise for the electro chemist to do all in his power to avert those dangers which may result from the free play of wrongly instructed public opinion.

It is a remarkable paradox that the whole civilized world in now engaged in fighting a barbarian Kultur that is logically the greatest exponent of State ownership, for the theory of that Kultur calls for the most complete subordination of the people to the State, and yet at the same time some of those who are most eager in their war against this ideal of state supremacy are foremost in advocating state ownership of everything. The methods of state ownership, however, are different in a democracy from those followed in an autocracy. In the case of the latter the feelings of the people are a minor consideration because they are trained to regard themselves as the servants of the state. This greatly simplifies the problem of those responsible for the management of the state-owned enterprise, for their attention can be devoted to working the state-owned institution, whatever it is, to the best advantage. This, however, being the sort of thing that civilization is fighting against, the managers of the democratic state-owned institution have a very different problem to contend with. They must consider first making their management popular, they must satisfy the average man who constitutes the majority of the voters and who is by no means competent to judge of good management, but thinks he is.

Theoretically the business is run for the benefit of the people, practically it will be run for what the people **think** is for their benefit. In the case of the privately owned business the measure of the success met with in running it is relatively simple, for it may be determined by the dividends of the company. The measure of the excellence of management of the publicly owned business is by no means so simple. The public, however, must be convinced that it is benefitted and it is by no means easy to convince it that the best management is beneficial. The path of least resistance is often found in bad management.

Something of this sort is what must be feared in the great experiment undertaken by the Province of Ontario. The Hydro Electric Commission has dwelt very strongly on the great benefits to the public to be derived from the use of hydro-electric energy by municipalities, by the house-holder, by the farmer, etc. Now it has already been shown that the use of electric energy for such purposes has for one of its characteristics a low power factor and that a hydro electric source may be not by any means the most economical method of generating electrical energy for these purposes, consequently the argument that because the source of the current is hydro-electric, therefore it can be sold to the municipality, to the house holder, to the farmer, to the manufacturer, more cheaply than would be possible were it derived from any other source, is fallacious. It might be correct to argue that the true interests of the country are found in using an inexhaustible supply of energy, waterfalls, in the place of an exhaustible supply like coal, but it is not true that the hydro electric source is the cheapest for all purposes. An argument along such lines is not so likely to catch the popular fancy, consequently the fallacious argument is more apt to be chosen. It has the further advantage that it will deceive most people for a long time. Another trouble connected with hydro electric generation of energy is the transmission cost. The greater the distance to the consumer from the hydro electric source the less economical it becomes to transmit the current not only on account of transmission losses, but because of the investment in and maintenance of the transmission line. There is a tendency, however, for the public to consider that discrimination is shown if those near the hydro electric source can get much cheaper current than those at a distance. Even the more broad-minded layman cannot appreciate properly the cost of transmission and distribution.

Under such circumstances, the managers of the publicity-owned hydro plants are in a difficult position for they are forced to consider the desires of the majority even though this may involve bad management of the business.

The electrochemist and the electrometallurgist are particularly apt to suffer from the mismanagement of the government hydro-electric plant because they of all others are the most satisfactory customers for hydro-electric energy. They take the power in large blocks, reducing in this way distribution costs, and they have a load factor which in their own interests is kept as near 100 per cent. as possible. They therefore are entitled to a far lower rate for the current they use than the majority which takes relatively small blocks of power involving high costs of distribution and having load factors ranging from 50 to 8 per cent. But these less satisfactory customers cannot see why there should be such a difference between the rates they have to pay and those of the electro chemist and electrometallurgist, and therefore suspect that these must be regarded as wretches of the same class to which they have been taught all privately owned hydro-electric companies belong. Because it is not obvious that electrochemistry and electrometallurgy are of great benefit to all and that consequently anything that hinders their development or increases the cost of their products is injurious to all, the ordinary consumer must be placated with rates which actually mean discrimination against electrochemical and electrometallurgical processes.

The war has probably done something in educating people in regard to the importance of electrochemistry and electrometallurgy and also in the relation of hydro-electric energy to their activities; but a great deal more is needed before the lesson is learned and the difficulties of teaching are enormously increased by phenomena like the Ontario hydro-electric experiment. The advocates of state-ownership probably have neither the inclination nor the knowledge to carry on a campaign of education which will teach people what fair rates are. The

immoral campaign of abuse of all privately owned companies, which characterises the activities of most of the advocates of state ownership, has taught the majority of the public to look on all private enterprise with suspicion. That there have been very serious evils connected with private enterprise no fair-minded observer will deny, and the skilful use of them to poison the mind of the public against all private enterprise has made that method of attack by the state ownership advocate the easiest and therefore the one to be adopted. By representing the public as the slaves of private enterprise, the astute politicians playing the public ownership game can divert attention from their own tactics, and while crying out against the tyranny of the private enterprise they can establish a tyranny far harder to attack.

Take for example some of the legislation that has been associated with the activities of the Ontario Hydro Electric Commission. It may be a troublesome and expensive undertaking; nevertheless, when a private enterprise goes too far in its disregard of the public it is possible to have resort to the courts. This might be annoying to the Hydro Electric Commission; hence we find a law which says:

"No action shall be brought against the Commission or against any member thereof for anything done or omitted in the exercise of his office without the consent of the Attorney-General of Ontario." (3)

Again, the Hydro Electric Commission's pawns, the municipalities, have passed by-laws which are of dubious legality on account of certain legal conditions not being fulfilled a legalising law is passed thus:

> "And the said by-laws of certain municipalities are hereby confirmed and declared to be sufficient, legal, valid and binding for the purposes thereof." (4)

Perhaps a recalcitrant Mayor, as in the case of the Town of Galt, may decline to execute a contract in which case something of this sort may be resorted to:

> "The said contract as so varied as aforesaid shall be treated and conclusively deemed to have been executed by the said Corporation of the Town of Galt." (5)

Actions have actually been brought against the Hydro-Electric Commission in which case the simplest way out is again found in legislation:

> "Every action which has been heretofore brought and is now pending wherein the validity of the said contract or any by-law passed or purporting to have passed authorizing the execution thereof by any of the Corporations hereinbefore mentioned is attacked or called in question the jurisdiction, power or authority of the Commission or of any Municipal Corporation or of the Councils thereof or any or either of them to exercise any power or to do any of the acts which the said recited Acts authorize to be exercised or done by the Commission or by a Municipal Corporation or by the Council thereof, by whomsoever such action is brought shall be and the same is hereby forever stayed." (6)

The most evilly-disposed private company would find it difficult to get such legislation and the public ownership officials must be driven to great straits to resort to such methods. Nevertheless, the number of people who are convinced that public ownership is beneficial or at least want to try how it works is so great that the experiment will certainly be carried out very thoroughly and the Ontario hydro electric systems may become a state monopoly, plainly the object that is in view. There will, however, probably be a reaction against that complete Prussianizing of the hydro electric systems which would be necessary before the incentive to bad management and discrimination is eliminated and, therefore, if electrochemistry and electrometallurgy in Ontario is not to be hindered in its development for a long time to come it is most important that the public be so instructed that it has an opportunity to form a true judgment as to what is and what is not a fair rate for electric service. For the uninformed it is very difficult to understand why he should in justice pay enormously more for a kilowatt hour used in house lighting than the electrochemist or electrometallurgist pays for the same unit of energy used in his electrolytic cells or his electric furnaces.

If, then, electrochemistry is to become one of the chief developments in Ontario, it is necessary for electrochemists seriously to plan a campaign of education having for its object a widespread instruction in the value of electrochemistry to the country; in the relation of electrochemistry to hydro-electric development; in the factors entering into the cost of electric current supplied to electro-chemical establishments as well as to other users of electric current. Unless this is done it is inevitable that government ownership of the hydro-electric systems will result in the electro-chemist and electro-metallurgist being forced to bear more than their fair share of the cost of generating and transmitting the current. The campaign is a difficult one, there is no use in shutting our eyes to that fact, for it will not be looked upon with favor by those who see in public-ownership a political tool; but it is a campaign which should enlist the sympathies of all who are opposed to the Prussian doctrine of the complete subordination of the people to the State.

(3) 6 Edw. VII, chap. 15, Sec. 21
(4) 8 Edw. VII, chap. 19, Sec. 1
(5) 9 Edw. VII, chap. 19, Sec. 5
(6) 9 Edw. VII. chap. 19, Sec. 8

SOME WAR CHANGES AND POSSIBLE PEACE ADJUSTMENTS IN CHEMICAL INDUSTRIES*

By Grinnell Jones, Chemist on the Staff of the United States Tariff Commission

Among the chemical industries, the first to feel the stimulus of war was the explosives industry. The expansion of American smokeless powder plants was sufficient to prevent a German victory in France and Russia in 1915. It is not revealing military secrets to say that there has been some growth since 1915. We all hope that the peace terms will be so satisfactory that the military explosives plants themselves will no longer be needed. Nevertheless, there will be a permanent increase in the competitive strength of the American chemical industries through the growth of the subsidiary industries which now supply the raw materials to the explosives industry.

Our production of sulphuric acid is at least twice what it was before the war. The growth has been largely in contact acid, and therefore when the demand for explosives disappears, the American chemical industries will have available large supplies of pure and concentrated sulphuric acid. Moreover, the growth of the acid industry has been made possible by a great increase in the production of American sulphur and by a smaller, although significant, increase in the mining of pyrites.

The nitric acid industry has grown relatively more than the sulphuric acid industry. The output of nitric acid from Chilean nitre is now more than ten times as great as it was before the war.

The significance of this growth of the sulphuric and the nitric acid industries to our dynamite, dyestuffs, and pyroxylic plastic industries need not be emphasized here.

Of greater significance than this stimulus to industries already well established has been the birth of new industries. We have a new synthetic ammonia and nitric acid industry. Plants have been built, and during the war at least, will be operated by the Government. When the full story of these plants can be told, it will reveal that American chemists have, under the pressure of war needs, been able to devise substantial improvements upon the Haber and Ostwald processes developed by the Germans before the war. These processes were the result of nearly two decades of work on these problems as a part of their military preparedness. It is not improbable that after the war nitric acid made from synthetic ammonia may prove to be cheaper

than nitric acid made from Chilean nitre. In any case, American agriculture will assuredly have a new large source of nitrogenous fertilizer materials.

In 1914 our production of crude light oil would have been sufficient for the production of only about 4,500,000 gallons of benzol and of about 1,500,000 gallons of toluol, and only a part of this was distilled. As is shown in our forthcoming report on the production of American dyes and coal-tar chemicals, in 1917 our output of benzol was 40,200,0000 gallons, of toluol, 10,200,000 gallons. In 1918 further substantial growth is to be expected through the installation of stripping plants at city gas works. The toluol is now going almost entirely into explosives as is also a considerable fraction of the benzol. When the demand for explosives disappears, it is to be expected that the prices of benzol and toluol will drop to the point where it will be profitable to add them to gasoline for motor fuel. A similar condition will probably exist abroad and, since America has the greatest known natural resources for the production of gasoline, benzol and toluol should be as cheap or cheaper here than abroad. Therefore the industries consuming benzol and toluol may be assured of ample supplies of these materials at favorable prices.

Before the war we had no synthetic phenol industry, whereas in 1917, as is shown in our forthcoming report, 15 plants produced 64,146,499 lbs. of phenol valued at $23,715,805, most of which was used in making picric acid. If this new industry is to survive, there must be a greater consumption of phenol in the industries for peaceful purposes. Fortunately, phenol is used as an intermediate in the manufacture of some representatives of every class of finished coal-tar chemical products, including dyes and lakes, photographic developers, medicinals, flavors, perfume materials, synthetic resins, synthetic tanning materials, and explosives. Leaders in the chemical industries are already making plans for the industrial development of the uses of phenol when the phenol is no longer needed for explosives.

Another war-baby is monochlorbenzol, which was made during 1917 by eight American firms, with an output of 24,624,099 lbs., valued at a little less than $5,000,000. The dye industry will use a part of this productive capacity permanently, but new discoveries by American chemists will probably be needed to utilize the total productive capacity. Incidentally, this product furnishes a new outlet for chlorine, a new by-product source of muriatic acid, and raises a new problem in the utilization of dichlorbenzol, an unavoidable by-product.

Before the war there was but one producer of aniline oil in the United States. In 1917 there were twenty-three producers with an output of 28,806,524 lbs., valued at $6,758,535. As only a relatively small proportion of this substance goes into explosives, the peace adjustments will not be complicated by a collapse of a military demand, but will depend primarily on the competitive strength of the American industry.

The war has also stimulated the production of mercury for the manufacture of fulminates. The American production has been about doubled since the beginning of the war. Formerly we had a balance of imports—now we have a larger balance of exports.

Poison gas warfare is also destined to have a permanent influence on the chemical industries. Although there is no reason to expect that uses will be found for phosgene and mustard gas on a scale approaching the present and prospective military use, the plants erected for their manufacture need not prove a total loss when the military demand ceases. Nearly all of the noxious substances used in poison gas warfare require chlorine for their manufacture, and an increase in the production of chlorine in the United States is therefore certain. There is much hope that some of the substances produced as intermediate steps in the manufacture of the poison gases may be utilized for purposes other than warfare, but these are matters not yet to be discussed. Phosgene, except for the dangers attending its use, is an excellent reagent for many processes involving chlorination or dehydration and for making Michler's ketone. Fortunately, the risk is using phosgene is greatly minimized by the development of the new gas mask. The intensive work which hundreds of American chemists have been and are doing to improve the design of the gas mask will undoubtedly prove a blessing to workmen exposed to noxious fumes in chemical factories throughout the world when peace is restored.

Still another industry which has ben stimulated by a direct war demand is the manufacture of acetone, which is used as a gelatinizing agent in the manufacture of the explosive, cordite; as a solvent for airplane dopes; and in the manufacture of poison gases. Before the war, acetone was obtained entirely as one of the products of the wood distillation industry, but there are now at least four new processes in commercial operation in the United States or Canada for the manufacture of acetone.

It has been found that glucose can be fermented by a suitable organism to give acetone directly. Butyl alcohol is a by-product of this fermentation and becomes commercially available in appreciable amounts. The development of uses for butyl alcohol is an attractive problem.

The other processes for making acetone produce acetic acid or an acetate as an intermediate step, and may therefore permanently affect the acetic acid industry. The most obvious and perhaps the simplest of these processes depends on fermenting molasses to alcohol, which is then converted into acetic acid by the rapid vinegar process. The conversion of acetic acid into acetone is an old and well-known process but the details have been improved.

Another process depends on making acetylene from calcium carbide. By the aid of a suitable catalyst, the acetylene is made to combine with water yielding acetaldehyde which may be readily oxidized to acetic acid. Still another process depends on fermenting kelp under such conditions that sodium acetate and potassium salts are secured.

The war has stimulated the production of many other products, a few of which may be briefly mentioned: castor oil for lubricating airplane motors; phosphorus for incendiary bombs and smoke screens; barium and strontium nitrates for signal rockets. The output of soda ash has increased by 68 per cent. since 1914, and the output of caustic soda has more than doubled.

New conditions in the chemical industries have also been created by the curtailment of imports. As a direct consequence of this stoppage of imports from Germany, a new American dye industry has been established. It is true that some dyes were being made in the United States before the war, but the makers relied on Germany for the necessary intermediates, with the exception of a small amount of aniline made here by a single producer. During 1917, 134 different intermediates were made by 118 firms. One firm made 53 different intermediates. Dyes were made by 81 firms. The total production of dyes in the United States during 1917 was approximately equal in gross weight to the annual importations before the war. The exports of American dyes exceeded in value, although not in quantity or variety, our imports before the war. The dye industry is not dependent on any imported raw material except sodium nitrate from Chile. Many important dyes are still lacking, but indigo and alizarin are now on the market in significant amounts, and the vat dyes for cotton derived from anthracene are coming.

A new potash industry has also arisen, but its future does not seem so promising as the future of the new dye industry. Here Germany has an inherent geological and geographical advantage.

It seems probable that many of the discoveries in regard to the use of substitutes for imported materials made under this pressure of war needs will prove of permanent value and have a permanent influence on international trade.

It is evident that the *status quo ante* cannot be re-established in the chemical industries any more than it can be re-established in international relations. Peace will bring new conditions of

international competion and radical readjustments in industry from a war basis to a peace basis.

*From a paper delivered at the 56th Meeting of the American Chemical Society, Cleveland.

HARDNESS OF SOFT IRON AND COPPER COMPARED*

By F. C. Kelley, Research Physicist, Research Laboratory General Electric Co., Schenectady, N.Y.

The experiments which I am about to describe were undertaken to determine how soft the purest grade of commercial iron produced in this country could be made after annealing, and how its hardness compared with that of copper.

The material used for these experiments was American ingot iron from two different manufacturers. The sheet bar material was 5/32 inch (4 mm.) thick. The copper was ordinarily cold-rolled copper from our stock room. Two different thicknesses, ¾ in. and 5/8 in. (19 and 16 mm.), were used in these experiments.

The hardness tests were all made by the standard Brinell method. The load applied in all tests was 500 kilograms, and the diameter of the ball used was 10 millimeters. Two different impressions were made upon each sample, so that we could have a check upon all tests.

The hydrogen annealing described below, under methods 3 and 4, which produced the best results, was done in a resistance furnace consisting of a porcelain tube wound with platinum ribbon. The wound tube was enclosed by a steel casing containing aluminum oxide for insulation. The hydrogen was dried and highly purified.

The vacuum anneal which gave the next best results was done in the Arsem vacuum furnace, which consists of a water- and air-tight casing containing a graphite grid or helix, gripped in water-cooled copper terminals, and enclosed by a graphite screen. The results of this anneal are given below under method 5.

Our factory anneal, given under method 2, below, is a treatment at 765° C. for 12 hours in a furnace heated by oil. The sixth method of treatment described below consisted of inclosing the iron samples in a copper tube, closed at each end by a copper plug, and then inserting the copper tube into the porcelain tube furnace wound with platinum described above. This porcelain tube was also stoppered at each end.

The iron was subjected to eight different treatments, which are outlined below:

1. A sample of the iron as it came to us in the sheet bar unannealed was first tested.

2. A commercial factory anneal was given to another where the temperature is held at 765°-775° C. for about 8 hours.

3. The factory-annealed sample, after being tested, was re-annealed in hydrogen at 900°-950° C. for three hours.

4. Another set of samples was annealed in hydrogen at 900°-950° C. for three hours, without a previous factory anneal.

5. The iron subjected to vacuum treatment was annealed at 1,000° C. for about two hours.

6. Samples were enclosed in a copper tube stoppered at each end with a copper plug so as to make it nearly air-tight. This tube was placed in a closed electric tube furnace and annealed at 950° C. for three and one-half hours.

7. A hydrogen annealed sample from the fourth experiment was rolled from 0.312 in. to 0.208 in. (8 to 5 mm.) or reduced to two-thirds of its original thickness.

8. A piece of the original sheet bar as received was given the same treatment as samples in experiment number seven.

The following are the Brinell hardness tests together with the treatments. Two tests are given on each sample:

	Brinell Hardness No. 1	Brinell Hardness No. 2
1. Unannealed as it comes in sheet bars	97.6	95.2
2. Factory annealed	79.4	80.0
3. Factory annealed sample reannealed in hydrogen	57.8	63.0
4. Hydrogen annealed	62.2	61.0
5. Vacuum annealed	62.2	65.8
6. Annealed in closed copper tube	66.6	66.0
7. Cold rolled to 2/3 of its original thickness after a hydrogen anneal	95.7	95.7
8. Cold rolled as received to 2/3 of its original thickness	110.5	112.5

It is of interest to know that this hydrogen or vacuum-treated iron may be whittled with a jack-knife as easily as our commercial copper.

The following are the analyses of the two makes of American ingot iron used in these tests, the iron having been determined by difference:

	1	2
Iron by difference	99.915	99.908
Carbon	0.05	0.06
Manganese	0.02	0.02
Silicon	trace	none
Sulphur, gravimetric	0.010	0.010
Phosphorus	0.005	0.002

Four different experiments were tried on the copper, which are given below:

1. Commercial copper bar as it comes to us was tested without any treatment.

2. Commercial copper bar 5/8 inch (16 mm.) in thickness was hammered cold to two-thirds of its original thickness.

3. A piece of copper bar ¾ inch (19 mm.) in thickness was annealed in a commercial gas furnace to about 600° C., so that it was dead soft.

4. A piece of the same bar after receiving commercial anneal was rolled to two-thirds of its original thickness.

The following are the results of the above tests:

	Brinell Hardness No. 1	Brinell Hardness No. 2
1. Unannealed copper bar	82.2	79.2
2. Unannealed copper hammered to 2/3 of its original thickness	87.4	96.8
3. Commercial annealed copper	40.6	40.2
4. Commercial annealed copper rolled to 2/3 of its thickness	89.4	92.6

The sample which was hammered was hit with a steam hammer, and shows that it received a little more working in one spot than another, due to the fact that the face of the hammer was not parallel with the block upon which the copper was hammered. To check the result, I rolled a piece of copper so that the reduction would be uniform, and the results are nearly the same.

The following conclusions may be drawn from these experiments:

American ingot iron subjected to a hydrogen anneal gives iron with a hardness about 20 points higher than that of dead-soft copper, while a vacuum anneal is nearly as good.

If annealed copper and annealed iron are each worked to produce a one-third reduction in thickness, the hardness of the copper increases over 100 per cent. of its original hardness, while iron increases only about 60 per cent.

The range of hardness between dead-soft copper and commercial copper as we receive it is between 40 and 80, while the range of hardness between hydrogen-annealed ingot iron and the commercial material ranges between 60 and 95.

Carefully annealed ingot iron could be used in many places where copper is now used because of its softness.

*Paper delivered before the 34th Meeting of the American Electro-Chemica Society.

The Canadian War Mission at Washington and Canadian Industries

First Fall Meeting of Toronto Section of Society of Chemical Industry

On November 21st the opening meeting of this Section was held in the Engineers' Club, Toronto.

Following the usual dinner, the Chairman, Prof. E. G. R. Ardagh, outlined the policy of the Section for its coming meetings. The program for the season will consist of addresses given by men well able to speak on very general subjects of both industrial and chemical interest. In this way it is hoped that not only chemists but leading business men and industrialists may enjoy more active interest in the meetings that are held. In December Mr. T. H. Wardleworth will speak on "The Effect of War and Peace on our Chemical Industries," and early next year Dr. A. B. Macallum, of the Honorary Advisory Council for Scientific and Industrial Research, Ottawa, will give some account of the great work being carried on by the Government in his Department.

The Society of Chemical Industry has now established an Associate Membership, which gives all the privileges of membership in the local sections to those who do not wish to subscribe for the journals of the Society.

The meeting was one of the largest ever held by the Toronto Section, showing at once the great interest existing at present in the chemical problems of industry and the high esteem in which Prof. Bain is held by all those men among whom he has worked for years.

Prof. Bain spoke at length regarding his work in connection with the Canadian War Mission at Washington. During the past nine months he has had his headquarters in the American Capital. He traced the development and growth of this Mission from the time the first Canadian manufacturer went to Washington for a contract, until the signing of the armistice a few days ago. This Mission was formed to bring order out of chaos, and give Canadian manufacturers a friendly headquarters in Washington, where a representative of their Government would be at their service. All this work was organized under the leadership of Mr. Lloyd Harris, now in England as Trade Commissioner. Four men guided the work—Mr. Lloyd Harris, Mr. Rolph, Mr. A. H. Scott, and Mr. Ross McMaster. Their staff consisted of—

(1) Expert mechanical engineer.
(2) Expert railroad man
(3) Director of steel supplies for Canada.
(4) Director of all chemical supplies.
(5) Department of Licenses and Priorities.

No matters connected with food, fuel, or of a diplomatic nature were handled by the Mission.

One of the chief functions of the Mission was to obtain orders for Canadian factories. A record in diplomacy was set up by the members, and their excellent work was more than upheld by our Canadian manufacturers. At first it was difficult to obtain orders for Canada, but the wonderful work done along lines of prompt delivery very soon changed the reputation of Canada at Washington. It is most satisfactory for us to know that orders given for shells, explosives, aeroplanes, acids, etc., were delivered always on the minute from Canadian firms, and in many cases went ahead of time. Many of the larger American plants had not as yet reached their stride, and were naturally slower on delivery.

Matters connected with licensing and priority of attention took up much of the time. Shipbuilding really came first and war industries in general next. The machinery of organization was so complex that long delays were caused between the War Industries Board and the War Trade Board. Big problems were being faced continually. The importation of Spanish pyrites was reduced from 900,000 tons to 125,000 for six months. Every source in America was taxed to its utmost and Canada supplied 400,000 tons, or increased production 30 per cent. Examples of difficulties overcome were quoted. A ruling was made that only those shipping caustic soda into Canada in 1917 could ship it in 1918. This caused much trouble, and it was eventually stopped. When all the chlorine was commandeered many of our smaller towns were unable to protect their water supply, as we do not produce sufficient chlorine in Canada for our own use. These restrictions were removed in cases of great need. The complexity of things is shown by the way the scarcity of sugar reacted on the regulation of Toluol, as this was needed to make saccharin. In the matter of nitrates, our farmers suffered last year, as none were imported, while the American farmer received two-fifths of his usual supply. In connection with platinum, Canada was allowed to buy new material from the United States in return for the equivalent in scrap.

For a time Canada was short on acid phosphates for fertilizers. Canada imported 29,000 tons last year, and this year some 40,000 tons will be required. The manufacture of this product here is on the increase, and we are now able to obtain all the raw rock necessary by agreement. Arsenic, although a chemical, is handled by the Food Administration, as it is used as an insecticide. The same organization controls the sale of ammonia completely. All wood products were handled by a Department of the War Trade Board. A very complicated situation arose in connection with tanning extracts. Heavy importation from South America was shut off. Our hemlock tonnage had practically ceased. The situation was aggravated by lack of labor and poor transportation from some Southern extract plants. All these factors made the strictest control necessary to assure fair distribution. It must be said, however, that Canada has received very fair treatment from the War Industries Board of the United States Government. What Canada has done in the war has been recognized, and our name is well established in a new sense throughout the whole of the United States. We have indeed received many favors.

In the latter portion of his address, Prof. Bain spoke in detail regarding the wonderful work that had been done in the United States in connection with gas warfare. The development work was carried on in three places—

(1) The American University near Washington did the necessary research work in connection with new gases and their toxic effects.

(2) Small scale plants were established at Cleveland.

(3) Producing plants were established at Edgewood Arsenal, near Baltimore. These plants covered some 200 acres.

In the early stages chlorine alone was used, but this was found unsatisfactory, inasmuch as it quickly blew away in the air. The later gases were really heavy oils that slowly volatilized. Three of these were most important—phosgene, chloro-picrin and mustard gas. These are all liquids. Most interesting points regarding the manufacture of various gases in large quantities were touched upon.

The engineering efficiency of the plants was so good that it was possible to work in all parts without meeting even a trace of the gas.

The present and future situation in the chemical industries of Canada was ably summed up by Prof. Bain under various

headings.

In 1915 the United States produced 4,315,000 toons of 50° B. sulphuric acid. In 1918 they produced 8,300,000 tons of 50° B. acid. The present output is 4,000,000 tons over the maximum peace use.

In 1913 Canada consumed 46,000 tons of 66° B. and in 1918 we made 144,000 tons of 66° B. We ourselves have a surplus of 100,000 tons. We could use 14,000 tons in acidulating our own phosphate rock, but the rest of it has yet to find even a prospective use. It is possible that further developments in the manufacture of caustic soda and liquid chlorine might be made here, to the limit of our own consumption at least.

In the field of Nitrogen Fixation, Prof. Bain thought that our water powers should give us a chance to compete with the Chili nitrates. We are not likely to have the competition of the United States, as they have few blocks of power above 10,000 K.W. available in the East. The Government should consider these projects from military and agricultural standpoints.

The pulp and paper industries of Canada offer as excellent opportunities for research work in chemistry as perhaps any single field. It should be made peculiarly a Canadian industry.

Little hope was thrown out for the establishing of any large dyestuff or pharmaceutical activities here. We need a larger population to dispose of the by-products. We may produce a few specialities and build up on these.

In general, however, we must rely on our wealth of power and peculiar raw materials and develop our electro-chemical industries, our forests and mines, to their highest efficiency. There is no immediate future for us in organic lines. The following key industries should be established by Government action:

(1) Sulphuric acid.
(2) Nitro-cellulose.
(3) Glycerin
(4) Nitrates.

Everything may be modified by the application in Canada of research work that may be carried on under Govenment direction. Properly protected patents may establish industries here eventually if our research men develop the fields.

Following Prof. Bain, Mr. Nieghorn discussed the general situation, pointing out many of the difficulties that had to be overcome before new chemical industries could be established or old ones expanded. Transportation and lack of suitable raw materials tend to discourage the establishing of many industries here, such as the manufacture of sulphate of alumina and acid phosphates.

Mr. H. Watters, of Ottawa, pointed out the fact that more general recognition of the work of such men as Prof. Bain and other leading chemists would increase from year to year, as the result of the war.

A motion was made by Prof. Lash Miller and adopted by he Section that the executive committee be instructed to draw up a memorandum for presentation to the Dominion Government urging the importance of maintaining in Canada such key industries as the manufacture of sulphuric acid, glycerin, nitrates, and nitro-cellulose. It wa suggested also that the other sections of the Society in Canada be asked to co-operate in this matter.

A hearty vote of thanks to Prof. Bain was moved by Mr. J. Murray and seconded by Mr. H. Van der Linde.

Prof. Bain returns to Washington as acting secretary of the Canadian War Mission.

CHEMICAL SOCIETY NEWS

The Canadian Pacific Section of the Society of Chemical Industry report that their programme of meetings for the winter season is well under way. In December Mr. S. Barwick will read a paper on "Ferro-Alloys and the Hardening of Steel." Professor Douglas McIntosh will also give a paper on "Gases Used in the War." Already this Section is extending its influence, and has received applications from Japan for membership.

THE WORK OF THE UNITED STATES BUREAU OF STANDARDS

An Address by Dr. Stratton, Director of the Bureau, Before The Royal Canadian Institute, Toronto

On the occasion of the seventy-first anniversary of the founding of the Royal Canadian Institute, Dr. Stratton, of Washington, addressed a large audience in the Physics Building of the University of Toronto on November 23rd. No one could possibly be in a better position to advise those men in our country who are striving to advance the cause of scientific industrial research than Dr. Stratton. After sixteen years of concentrated effort along these lines, Dr. Stratton comes to Canadians with the words, "Science should begin after the war." The Bureau of Standards is in reality an industrial research institution. Its organization has proven equally efficient in military as well as purely industrial activities.

In opening his address, Dr. Stratton reviewed the fundamental problems arising in the creation of standards and explained the necessity for the most careful work in establishing true standards for the engineer and industrial worker. Standards and organization in the Bureau must be based on industrial usefulness. Three varieties of standards must be considered:

Standards of Quality
Standards of Performance
Standards of Practice

The staff of the Bureau is organized under the general departments of Physics, Chemistry and Electricity. This plan seems to fit in well with most industrial needs.

A series of most interesting and instructive slides were shown, illustrating laboratory and research apparatus, followed by pictures of the various buildings.

In many ways the Bureau has assisted in the work of war. In the manufacture of standard gauge it was found that the idea of making the unit of length that of a wave length of light worked best, and an instrument was used for this purpose that no one ever considered in peace times would be of any value during time of war. From now on, such precision standards will be in light waves.

Practical assistance to industry was shown by a picture of a freight car which carried from town to town very heavy but accurate weights for testing large scales. Chronometers were unobtainable in sufficient numbers for the navy, and watches were carefully standardized by the Bureau for all sorts of purposes.

Without standards no research is possible, and research at distant points is now greatly facilitated by the fact that the individual may obtain precision instruments quickly from the Bureau. For $1 the Bureau will standardize a thermometer much better than it is possible to do it in the ordinary laboratory. The same is true of such instruments as the co-efficient of expansion and radiation. One instrument would actually measure the heat of a distant star and can be used also for measuring very high temperatures. These instruments have been of untold value in war work. It is now possible as the result of researches to send messages from one boat to another by non-visible light waves, using the short and long wave lengths. Machinery for separating a non-explosive gas from Texas natural gas, which had nearly the same density as hydrogen, and which could be used with safety for war balloons, was worked out. Spectroscopic methods of analysis have been perfected, and have a wide application in industrial steel laboratories. Permanent spectroscopic color standards have been developed.

In specific industrial fields much good work has been done. Reliable standards for leather and paper have been worked out, and a small paper mill forms part of the laboratory equipment.

That portion of the work which appeals most to large manufacturers is the testing of working sizes of all sorts of building materials, cements, brick and steel structures. The manufacturers are learning to co-operate and copy the methods of the

Bureau. Artillery wheels, trucks, aeroplanes, anchor chains, rubber materials, have all been made the subject of tests. Men from the Bureau go out to the various plants with the object of learning more than they teach, and a splendid feeling is worked up in the various industries.

Striking work has been done in developing American glass and ceramic industries. Dr. Stratton estimated that the ceramic work alone pays the entire maintenance of the Bureau. In optical glass the skill of the workman is the limiting factor of success. By a moulding process the kaolin pots holding 1,000 pounds of glass have been reduced in cost from $55 to about $9. Much work still remains to be done in raising the efficiency of the methods used in working up optical glass.

All varieties of engines may be tested under various conditions. One special room has been built for testing aeroplane engines. The pressure and temperature can be accurately controlled over wide ranges. A Liberty engine thus tested, which had a horse power rating of 500 under ordinary atmospheric conditions was reduced to 22 h.p. at the equivalent of 40,000 feet elevation.

The work has shown marked growth. New buildings are always under construction and one is about completed which will allow great expansion of work along industrial lines.

The whole address was designed to stimulate and fix the faith of industrial research workers in the value of their work.

Following Dr. Stratton, a short address was given by Dr. A. B. Macallum, of Ottawa, outlining plans under consideration in Canada.

Central Research Institute for Canada.

Dr. Macallum announced that it had been decided to ask the Government to supply $600,000 for a building, and $100,000 for salaries and the work to begin immediately. The results of questionnaires was disheartening. Few research men were at work in Canada. Plans were also under way for the establishing of well equipped research laboratories for post-graduate work in at least two Canadian universities. In Great Britain there are 20 trade associations or guilds, and it is hoped to organize Canadian manufacturers. They will pay the salaries of their men and the Government pay cost of plant, buildings, etc.

In replying to a hearty vote of thanks, Dr. Stratton said that he would be well pleased to have Canadian research men attached to the Bureau in Washington in order that they might learn what that institution could teach them. In return, he hoped that both he and a number of his fellow-workers would be given an opportunity to visit and learn in the research departments of the Canadian Government.

Mr. A. Hewitt, Manager Consumers' Gas Co., Toronto, proposed, and Mr. R. Y. Eaton, the T. Eaton Co., seconded a resolution that the Dominion Government be asked to supply the necessary funds in order that this work on the Central Research Institute of Canada, might be undertaken immediately.

RECENT CANADIAN PATENTS

187,052, October 15, 1918. Aluminous Abrasives, L. E Saunders. A small proportion of a Na compound is added to substantially pure alumina and the mixture fused to produce an abrasive whose individual crystals are perforated or cellular.

187,053, October 15, 1918. Aluminous Abrasives, L. E. Saunders, et al, Can. An abrasive having a fine grain of weak structure is made by incorporating a relatively small proportion of an alkali metal compound with bauxite and fusing the mixture in an electric furnace.

186,994, October 15, 1918. Process of Treating Metallic Oxides, J. W. Moffat, Can. Metallic oxide ores are reduced without fusion or flux in a suitable furnace at as low a temperature as possible to maintain the granular form of the charge, after reducing, oxidizing gases are excluded from contact with the charge while its temperature is above the lower limit at which oxidation can take place, then the charge is fused in an electric furnace in an inert or reducing atmosphere. The charge may be cooled after reduction before fusion to a temperature below that at which re-oxidation takes place (approximately 350° C.).

186,910, October 8, 1918. Electric Furnace, H. Freeman, Can. A furnace for making NaCN has a hearth of conducting material with a restricted crucible chamber, a tapered shaft leading to said chamber, a depending electrode located in the shaft and whose lower end terminates in the chamber and restricts the passage thereto, a tap hole from the chamber and means for plugging the tap hole at will.

186,911, October 8, 1918. Sodium Cynide, H. Freeman, Can. $NaC1$, $CaCN_2$ and C are fed into the furnace and the temperature raised to the chemically active temperature of the C before any substantial foaming takes place and the product is driven off as it is formed. The process is continuous.

186,820, October 1, 1918. Refractory Articles, S. C. Lindbarger, Can. The refractory contains graphite SiC and clay, the graphite being 15% by weight. The SiC grains prevent the formation of parting planes in the body of the molded mass.

187,017, October 15, 1918. Alloy, J. B. Grenagle, Can. An alloy of 40% Zr with Fe is made by mixing materials containing compounds of these metals and co-reducing them to form the alloy. Ti or Al compounds may also be reduced with the other metals to give desired properties to the alloy produced. The alloy is used for incandescent lamp filaments, glowers, arcs, etc. It is non-corrosive and resists acids and may be worked.

186,996, October 15, 1918. Machines for Making Briquets, McClure, F. D. Can. Structural features.

187,105, October 22, 1918. Method of and Apparatus for Segregating and Recovering Gases, F. A. Eustis, Can. SO_2 is recovered from gases by causing liquid to absorb the SO_2, then extracting the SO_2 from the liquid solution by subjecting the latter to heat and vacuum and thereafter subjecting the SO_2 to a cooling liquid to deprive it of the water vapor with which it may still be associated. Apparatus is also specified.

186,791, October 1, 1918. Apparatus for Treating Chemical Products, C. J. Leyes, Can. The apparatus comprises a heater with means for conveying material from a supply hopper therethrough to a receiving box. The frame in which the hopper and receiving box are mounted is higher at one end than the other and may be tilted in a vertical plane independent of the heater.

187,050, October 15, 1918. Process of Recovering Fixed Nitrogen, E. W. Haslup, Can. Volatile carbo-nitrids are produced by mixing a suitable oxide bearing material and C, submitting the mixture in a fuel fed furnace and in an atmosphere of producer gas to a temperature of about 1400° C., tapping off the carbo-nitride and producer gas mixture out of contact with air from a point in the furnace at which the temperature is sufficient to prevent condensation of the carbo-nitride which is cooled and collected.

186,775, October 1, 1918. Apparatus for Treating Ores, A. J. Carver, Can. In a gravity plant for ore treatment a revolving roaster has longitudinal members at its inner lateral surface, said members having a series of triangular-shaped recesses each having a notch at the apex nearest to the delivery end of the roaster. Other features are also specified.

187,099, October 22, 1918. Apparatus for Charging and Discharging Coal Gas Retorts, A. D. Cressler, Can.. The essential feature of this apparatus comprises, means for simultaneously loading a series of magazines in vertical position, means for tilting the series of loaded magazines into a horizontal position and means carried by each magazine consisting of a charge-regulating core for simultaneously charging, discharging and cleaning a series of retorts.

187,098, October 22, 1918. Gas Mixing Devices, C. A. Couch, Can. A mixing device for gaseous substances is cone-shaped and has elongated inwardly curved finger-like portions for imparting rotary motion to the gas as it flows therethrough. It is secured within the pipe by a clamping collar and has a fringe in the base portion of the cone to cause an even flow of gas.

Canadian Government Publications

By S. J. Cook, B.A., Public Analyst, Department of Trade and Commerce, Ottawa

[Notice.—Recent Government publications of scientific, technical or educational value, are reviewed here from month to month. Unless otherwise stated, these publications may be obtained free by those interested, upon application to the Department of the Government issuing the same.]

Department of Trade and Commerce

Food and Drugs Laboratory. Bulletin 413. Egg Substitutes 21 pp. The activities of these laboratories in protecting the public against food frauds is very commendable. The latest contribution deals with the analysis of 144 samples of such products as are sold to the public as substitutes for the old-fashioned eggs, the price of which has so risen that the consumer may well look for some good substitute. Unfortunately it seems he would look in vain, for the report states that "corn starch, colored with a yellow dye is the chief constituent of these mixtures." The paper gives a readable outline of the development of the egg substitute business and describes the methods of manufacture and general composition. References to the value, or rather the lack of value, of these so-called food substances in cooking are also considered. The analytical data reported are discussed and interpreted so that the average intelligent reader may follow the explanations without difficulty. A table of comparative values serves to emphasize the worthlessness of most of these products, and the specific analytical results serve to define the contents of the products on the Canadian market. It is recommended that egg powders and powdered egg be defined under the Adulteration Act without delay.

Dominion Bureau of Statistics. Monthly Bulletin of Agricultural Statistics, September, 27 pp. Any one who wishes to keep informed regarding crop conditions throughout the country should read this bulletin regularly. The field crops of Canada are reveiwed and it is pointed out that for the whole of Canada in 1918 the average yield per acre is estimated at 16½ bushels for fall wheat as compared with 21½ bushels last year and 23 bushels the ten year average for 1908-1917. For spring wheat the average is 12½ bushels as compared with 15½ last year and 19 bushels, the decennial average. Similar data are given for the other crops, and tables set out in detail the figures for the various grains in Canada and in each of the Provinces. Reports from representative parts of the Dominion and from other countries, together with the monthly range of grain prices, complete the issue.

Dominion Bureau of Statistics. Monthly Report of the Trade of Canada. August, 1918, xx. pp. and 365 pp. This report was formerly issued by the Department of Customs. It consists of a set of complete tables outlining the imports for consumption, and the exports for August 1917, 1918 and the five months ending August 1916, 1917 and 1918. In addition, tables are furnished giving a summary of the imports and exports for each month in the three previous years and the completed months of the current fiscal year; total imports and exports; imports and exports between Canada and the United Kingdon, and between Canada and the United States. Exports from Canada by classes for the month and for the five months ending August 1909 to 1918; and similar data for the different countries trading with Canada. All these data are then tabulated in detailed tables so that one may find with the minimum of effort anything in regard to Canadian trade with other lands.

Monthly Report of Trade of Canada, September, 1918, xx. pp. and 365 pp. See the review of the August number. For August read September.

Dominion Grain Research Laboratory. Bulletin No. 1, Report of Trial Shipment of Bulk Wheat from Vancouver via the Panama Canal to the United Kingdon. By F. J. Birchard and A. W. Alcock. This pamphlet records the experimental work undertaken by the Department of Trade and Commerce through the agency of its Grain Research Laboratory to determine the feasibility of shipping grain from Vancouver via the Panama Canal to the United Kingdom. All the grain was carefully selected and examined previous to shipment and a representative of the Laboratory accompanied the shipment in order to make the necessary observations en route. The grain used is described, the arrangement of the cargo, the placing of the electric resistance thermometers in the grain are outlined and illustrated by the use of numerous diagrams. The data obtained are tabulated, and it is concluded that if sound grain containing probably not more than 14.5 per cent water is kept free from water, and the portions near the stokehold kept cool by ventilation, the cargo will probably arrive at its destination in good condition. It is recommended that further trials be made.

Commercial Intelligence Branch. Weekly Bulletins Nos. 770-773. The end of the war is reflected in No. 773, for in place of the customary "War Measures, Canada," on the first page, there is an article entitled "Readjustments," by Sir George Foster, Minister of Trade and Commerce. We may soon hope to see the entire discontinuance of the "War Measures" articles which, however, have been a much-read section of this little weekly. United Kingdom imports are treated at length in the same issue. The pages devoted to trade inquiries often carry some news of chemical wants, and the reports from the various centres where Canada has trade representatives, are always of some particular interest. A supplement to one of these Weekly Bulletins this month is devoted to a study of the Lyons Fair, the newly created rival of the famous Leipzig International Fair. The Lyons Fair is intended to be international in scope and is being established on what is meant to be a permanent basis. Already the Leipzig Fair admits the presence of a real rival in this despised little array of wooden buildings, and the building of a new Fair Palace gives some foundation for the admission. Canada will be represented at the next Lyons Fair. The Minister of Trade and Commerce has applied for thirty booths and the Government is prepared to aid exhibitors in the matter of payment for the booths and will also pay the freight upon exhibits from the port of embarkation to Lyons.

Canada Food Board. Canadian Food Bulletin. November, 20 pp. Review of Food Control Work, the Story of the Food Board and the Pacific Coast Fish, new wheatless recipes and a summary of Food Board orders.

Honorary Advisory Council for Research. Bulletin No. 6. The Heating of Houses, Coal and Electricity Compared. By A. S. L. Barnes, 14 pp. This little bulletin is sent out for the purpose of eradicating, if possible, from the popular mind the idea that electricity is destined to replace coal or other fuels in the heating of houses, etc., on an extensive scale, and at the same time to show in what way and to what extent electricity may be used to advantage. The difficulties of using electricity on the large scale are the amount of energy needed and the high cost as compared with other sources of heat. Costs for average houses are tabulated for different methods of heating, and it is shown that with electricity at 0.35 cent per K.W., the cost of coal would have to rise above $15.50 a ton before the cost of heating would be at all comparable. The use of electric heaters as auxiliary to other systems is recommended to a limited extent.

Department of the Naval Service

Fisheries Branch. Quarterly Bulletin of Sea Fishery Statistics. January-September, 1918, 12 pp. Returns by provinces of all sea fish caught and landed in a green state, and the estimated proportion marketed during the nine months ended

September, 1918. Similar data for the whole of Canada are also given. The United States, the British Isles, Newfoundland and Norway returns of sea fisheries are tabulated.

Department of Mines (Geological Survey)

Museum Bulletin No. 28. The Hawks of the Canadian Prairie Provinces in their Relation to Agriculture. By P. A. Taverner. 18 pp. iv. plates, 7 figs. The seven groups of hawks found in this district are described in detail, and an attempt is made to remove general prejudice against these birds, or at least to encourage the study of them so that the harmful may be separated from the innocent, and destroyed intelligently. The plates are in colors and are accompanied by descriptions.

Summary Report, 1917. Part B., 48 pp. Reports of work are given under the following heads:

Explorations in Yukon Territory
Economic Geology of the Hazelton District
Reconnaissance along the Pacific Great Eastern Railway
Indian River Copper Deposits.
Clay and Magnesite
Diatomaceous Earth along the Great Eastern Railway
Investigations in the Slocan District.

MONTREAL LETTER

(Correspondence of the Canadian Chemical Journal, By J. C. Ross.)

MONTREAL, Nov. 25th, 1918.

The chemical market is in a transitory stage and a hand-to-mouth policy in buying is being pursued by both jobbers and consumers. With the war at an end, a number of restrictions and embargoes which were in effect have been removed and the indications are that others will be modified from time to time. This has made the price of chemicals somewhat easier, especially in such lines as caustic soda, shellacs and other commodities, where the restrictions have been lifted. At the same time, only certain specified people are allowed to ship while the quantity is limited to a greater or lesser extent. In addition to that, there is a feeling of uncertainty regarding the future trend of supplies and prices, which makes buyers extremely reluctant to stock up. Undoubtedly there is a re-adjustment period coming, when prices will be changed from a war basis to a peace footing.

One of the largest chemical houses stated that there had been no large cancellation of orders, but at the same time admitted that the industry was in a somewhat awkward position. While anxious to dispose of the goods they have on hand, they are advising their customers to adopt a hand-to-hand policy when purchasing. Dealers state that they do not know how prices will vary, but in a general way point out that the question of supply and demand will regulate the prices in chemicals, the same as in other commodities. Certain lines have shown a marked advance in the last two weeks, such as turpentine, which has advanced from $1.00 to $1.15 and $1.18. Rosin is also higher, but on the other hand certain commodities of a more or less war nature have shown a tendency to re-act in price. A very prominent chemist states that while he expects certain logwood manufacturers and the makers of explosives and certain jobbers who were called into being as a result of the war will quit doing business, but the great bulk of the chemical industry will survive the hazards of war and become one of our most important commercial industries in the days following the coming of peace.

The Society of Chemical Industry held their first meeting of the year on Wednesday, November 27th. As announced some time ago in these columns, the Montreal branch of the Society had planned a very elaborate and comprehensive programme, but the Spanish influenza put an end to all their activities. As a result of the influenza none of their meetings could be held, so the one which took place on Wednesday attracted more than ordinary interest. The Society of Chemical Industry have a tireless and efficient worker in Mr. W. B. Campbell, the secretary, and it is largely as a result of his efforts that the progressive programme has been got under way. At their meeting held here, the chemists made preparations to organize the chemical industry into a legally recognized institution, As it is at present, any Tom, Dick or Harry who cares to potter about with a few simple chemicals can call himself a chemist. For some time, the recognized members of the industry felt that this was doing them an injustice and now propose to take steps which will keep out the riff-raff. At the same time they are planning to have associate members who on a payment of small fee will be eligible for attendance at meetings, and in other ways enjoy some of the privileges of the full fledged members.

The coming of peace is going to test the chemical industry and reveal to the world whether it has been building on a sound foundation or not. Inquiries made of leading members of the chemical industry convey to the writer the conviction that the future of the industry is assured. While there may be a lessening of activities connected with explosive making, the real commercial side of the chemical industry is here to stay; in other words, those best qualified to know, say that the chemical industry in Canada is not a war baby, but will be able to survive after-the-war conditions.

New power projects continue to crop up in Montreal. In last month's letter some details were given of a new power project which had for its object the daming of the Back River and the generating of a very large horse power. A few days ago the City Commissioners were notified that an application had been made by J. R. Walker and Co. for permission to build a dam between Elm, Visitation and Cedar Islands on the Back River, and a large power house at St. Vincent de Paul. The new interests proposed to use the power generated largely for the operation of a cardboard mill in the neighbourhood. The surplus power, if any, would be transmitted to Montreal.

A new transmission line from Weedon to Sherbrooke, P.Q., is now in use, and as a result of this, the city of Sherbrooke has an additional 1,000 H.P. for sale, while the second service from the same source will shortly give them another 1,700 H.P. Before the new line was completed, Sherbrooke was selling 5,200 H.P. to manufacturers in their city.

In reply to inquiries made by the Honorable G. D. Robertson, Minister of Labor, the Canadian Pulp and Paper Association, with headquarters in this city, announce that the paper mills of the country are in a position to largely increase the number of their employees at present at work and in this way relieve the labor situation caused by the release of munition workers. At the same time the Canadian Export Paper Co. announce that they are planning to export large quantities of pulp and paper to South America and other countries. A similar request from the Minister of Labor to the Canadian Lumberman's Association resulted in the calling of a meeting of the executive which was held in Montreal on the 26th instant. Mr. W. C. Power, of Quebec, president of the Association, stated the lumbermen are prepared to absorb at least 10,000 workmen from munition plants and other war enterprises. In addition to that, various ship building plants throughout the country are expected to assist in taking up the slack in the labor market caused by the cessation of hostilities.

A statement just issued by the Canadian Pulp and Paper Association shows that for the first six months of the present fiscal year, the exports of paper, pulp and pulp wood amounted to $49,964,000. This compares with $36,274,000 for the corresponding period last year, and $24,141,000 in 1916. Of the exports for 1918, chemical pulp amounted to $15,903,000 as compared with $9,492,000 last year and $5,957,000 in 1916. The paper exports were $22,221,000, $18,074,000 and $11,298,000 respectively.

MEETING OF MONTREAL SECTION, SOCIETY OF CHEMICAL INDUSTRY

The first meeting of the season of the Society of Chemical Industry, Montreal Section, was held at the rooms of the Engineering Institute of Canada, 176 Mansfield Street, Montreal, on the evening of November 27th. Fifty-one enthusiastic members were present and took part in the discussion which was held in place of a regular programme. Among the suggestions discussed was the matter of associate membership in the society. It was decided that there should be provision for any one interested in chemical matters, to join the local section of the society as an associate member. In this way, a number of persons would be brought in touch with chemical problems through attendance at meetings, who otherwise might feel more or less like intruders. Applications for such membership will be passed on by the local executive and the fee is to be $2.00 per year.

The meetings of the local section are to be held on Friday evenings at the Engineering Institute of Canada. It is expected that there will be at least one meeting a month during the season, and that the final meeting will take the form of a dinner and social evening.

The principal discussion was on the subject of organizing the chemists of Canada into a strong united body with the idea of raising the status of their profession. Much has been done in England toward accomplishing this end and the progress that has been made on the other side was well covered in a fine paper read by Mr. H. J. Roast. Mr. Roast is Sec.-Treasurer of a committee appointed at the Ottawa Convention last May, for organizing the chemists of Canada. He is in charge of the necessary propaganda in connection with this movement. A resolution was passed by the meeting supporting such an organization of chemists as was outlined in the discussion. Short papers were read by Dr. Bates, Dr. Baril and Mr. W. B. Campbell on what has been done towards organizing engineers, doctors, and architects; others took part in the discussion. Dr. L. F. Goodwin favored some provision for discriminating as to the status of members, it being the feeling that membership should be limited to bona fide chemists. To this end Mr. Roast suggested that forty men who might be termed master chemists, men who are eminent in chemical work, should be selected as charter members of chemical industry. These men could be found in the teaching profession in Government laboratories and in industrial work. This group would pass all applications for membership. Qualifications should be based on chemical ability. Indication or proof of qualifications could be ascertained by accepting college degrees in chemical subjects as proof for college graduates, but for men in industry, who have grown into chemical positions and who have not had a college training some form of examination would probably be necessary. In any case the principal desire is to establish some standard for membership in order that the name chemist would really mean something more than druggist to the public.

Dr. Hersey spoke of the Institute of Chemistry in Great Britain and suggested that examinations might be held in Canada for membership in this organization and that such qualifications would hold for the whole empire.

This movement for organizing Canadian chemists has been definitely under way since last May, and it is hoped that every Section of the Society of Chemical Industry and all other organized groups of Canadian chemists will give it full discussion at their meetings in order that something tangible may be brought forward at the Convention next Spring.

REMOVAL OF EXCISE ON INDUSTRIAL ALCOHOL

A recommendation from the Honorary Advisory Council for Scientific and Industrial Research has been sent to the Dominion Government that the excise on alcohol for industrial purposes should be taken off and that the Government should buy from the distillers all the alcohol to be used in the industry. It is suggested that the Government should then resell this alcohol, at a slight advance, to every firm using alcohol for industrial purposes, and that any firm using ethyl alcohol for industrial purposes should be licensed to that end, a report being made to the Government monthly of the amount consumed. It was also recommended that ethyl alcohol should be allowed duty free to hospitals and university and college laboratories for teaching and research purposes.

It is estimated that from the waste sulphite liquor from the paper mills near the St. Lawrence River 2,000,000 pounds of industrial alcohol can be produced annually at a net cost of less than 40 cents a gallon.

FORMATION OF NATIONAL RESEARCH COUNCILS

In a lecture before the Royal Canadian Institute last month, at Toronto, Professor J. C. Fields, F.R.S., gave some idea of the magnitude of the research work now under way in the United States and plans for the future. The Dupont laboratories at Wilmington, Del. employ 1,100 chemists and chemical research costs this firm $2,000,000.00 a year. The Eastman Kodak Company spends $150,000.00 and employs 40 research men. Besides these there are the very large laboratories of the General Electric Co. at Schenectady.

Some general aims of National Research Councils were also considered. Business men are given an opportunity to co-operate with scientists and the results have been the very best. The enthusiasm begun while working on war problems should carry over into problems of peace reconstruction. The United States has appointed a scientific attaché to each of the American Embassies in London, Paris and Rome. Their business is to keep Washington posted on all scientific developments in these countries and also to put naval commanders in their vicinity who may meet with scientific difficulties in touch with the proper sources of information.

It may be said that at an international conference of representatives of national scientific societies held in London last month it was proposed that a National Research Council should be established in each of the allied countries. It was intended that ultimately these national research councils should organize information with regard to research going on everywhere in the world and that they shall conduct great research laboratories of their own. It was further suggested that an International Research Council made up of representatives from the National Research Councils should be established.

SUBSTITUTION OF NITRE CAKE FOR SULPHURIC ACID IN PICKLING STEEL

E. E. Corbett, Chemical Engineer, Bureau of Mines, Washington, has just published the results of much work in the above connection which had for its aim conservation of sulphuric acid. His report is very valuable in the sense that it is a collection of testimony on large scale operations. The agent in both instances is sulphuric acid—in the one case used unadulterated, except with respect to the ferrous products of its action on the metal; in the other its action moderated by the presence of a salt which is inert with respect to direct attack on most metals, but whose influence gives nitre cake solutions certain selective properties desirable in a cleaning medium. A summary of this recent publication follows:

Cost

In calculating the economy of nitre cake pickling of steel over acid cleaning, a fair average charge for extra labor at the present rate, in handling between the car and pickling tanks, may be taken at $1.10 to $1.25 per net ton of nitre cake.

Further, the computation of the cost of nitre cake with the necessary freight charges must take into account the fact that the effective acidity, or pickling intensity factor, of the cake is

approximately 30 per cent of its weight. Actual experience in operation shows, however, that under proper control the acid of nitre cake, modified by the presence of sodium sulphate, is from ten to fifteen per cent more effective in scale removal than an equivalent pure acid solution used under similar conditions.

Summary and Extension

1. From ten to twenty per cent economy may be effected in steel cleaning by (a) suitable temperature regulation designed to check fume loss as well as steam and fuel waste; (b) the use of polarizers or inhibitors adequate to minimize dissolving of sound metal and to blanket entrainment of acid in vapors rising from the surface of the bath; (c) methodical chemical and mechanical control maintained to prevent live steam losses at worn fittings and acid waste in splashing, leaky equipment, and in spent solutions rejected before the acidity has dropped to a specified limit of 0.3 to 0.5 per cent or less.

2. Except in the cases of a few special processes, nitre cake may be substituted for 50 per cent of the acid now used for steel pickling. In those industries where time is not the controlling consideration the substitution may after trial be made even entire. The maintenance of production and the lining up of co-ordinate operations demands with present equipment, however, the use of acid to accelerate the action of the nitre cake solution; otherwise total substitution requires a 30 to 50 per cent. increase of tank equipment.

The exceptional instances in which the adoption of nitre cake pickling tends to introduce disproportionate hardship include (a) highly polished hard steel wire and drill rod; (b) butt-welded tubing for enameled conduit, the interior of which must be energetically pickled with a readily mobile, rapidly circulating acid solution for the removal of siliceous furnace bottom without undue reduction of the exterior wall; (c) the finer grades of tinplate; and (d) those processes and plants in which the spent pickle liquor is concentrated for copperas recovery.

Sand-castings should be cleaned with a mixture of sulphuric and hydrofluoric acids. High nickel-chrome and tungsten-vanadium-chrome alloy rod and wire are best pickled in mixed hydrochloric-sulphuric acid or with sulphuric acid in conjunction with common salt.

3. The chief objection to the use of nitre cake in the cleaning of tin plate and sheet stock appears to rest on a physical or mechanical problem. The cake is ordinarily added to the machine tanks in lumps, which, dissolving irregularly, lead to momentary irregularities of acid concentration and consequent burning of the sheet; or, added as a powder or ground cake at the surface of the bath, it deposits on the sheet and causes local pitting or smudging which appears on the finished material as pinholes or blisters. The preparation of clear solutions would seem to be the proper corrective of these faults.

4. The shipping and handling of nitre cake demands special cars and storage and an increase of transportation tonnage over that required for the equivalent acid. The increase of labor for handling is an essential item, though not a serious one except where extreme labor shortage obtains. Control of operation at the pickle tanks requires certain alterations of process of handling which the majority of plants are prepared to make.

5. The exploitation of nitre cake as a commercial material has been only too frequently accomplished by enthusiastic but, extravagant assertion of its effectiveness as cure for all the ills incident to pickling. Unquestionably it produces in most work a better metal surface than does acid alone; it reduces the fume nuisance, effects a saving of metal and acid, and aids in the utilization of a valuable technical product whose rejection at the point of production is a vast economic waste. But it can be regarded as a total substitute for sulphuric acid only under exceptional circumstances; its action is substantially slower than commercial acid solutions, and the labor required to handle it is necessarily greater. Its use as a beneficial substitute demands ntelligent experiment until the conditions governing its behavior n each separate line of work are fully understood.

CANADIAN PATENTS

Reported for the Canadian Chemical Journal, by A. E. MacRae, Ottawa

187,058, October 15, 1918. Metal Combination of Albumin, K. Kottmann, Can. Combinations of metals with albumin bodies used for diagnostic purposes consist of colorless or slightly colored powders, insoluble in water and the usual organic solvents and in which the metal is held in nonionised condition and from which the metal is liberated by treatment with decomposing ferments so that it can be detected by the usual reagents such as ninhydrins.

186,962, October 15, 1918. Process of Making Sulphuric Anhydrid, C. Ellis, Can. SO_2 and O are brought into contact with a catalyzer of chromic acid with a heavy metal oxide specifically tin oxide.

187,072, Oct. 15, 1918. Process of Purifying Magnesite, A. T. Elliott. Magnesite containing SiO_2 and CaO is treated with an acid leach containing C1 to dissolve the magnesite, the SiO_2 is removed from solution and the CaO precipitated by a soluble sulphate. The lime precipitate is removed and the magnesite precipitated by a soluble carbonate. This precipitate is removed and the solution is regenerated to acid condition for further use.

186,918, October 8, 1918. Aluminous Abrasives, L. E. Saunders, Can. The product consists of crystalline alumina associated with iron oxids and free from SiO_2 and TiO_2.

186,919, October 8, 1918. Abrasive Material, L. E. Saunders, R. H. White, Can. A crystalline aluminous product containing zirconia and a ceramic bond for the grains.

186,920, October 8, 1918. Aluminous Abrasives, L. E. Saunders, R. H. White, Can. A crystalline alumina product containing oxids of Si and Zr are made by fusing in an electric furnace a mixture of bauxide, a Zr ore and C, the C being in insufficient proportion to reduce the zirconia.

186,921, October 8, 1918. Alumina Abrasives, L. E. Saunders, Can. An abrasive containing a large proportion of B alumina associated with a Na compound is prepared by fusing an Al material with enough Na compound to effect the transformation of a large part of the alumina in the charge into the beta modification.

186,822, October 1, 1918. Apparatus for the Manufacture of Diphenylamine, A. E. Houlehan, Can. An autoclave has a column thereon of sufficient length to separate $C_6H_5NH_2$ from NH_3 by condensation due to air cooling. A valved outlet pipe is provided near the top of the column and a blowout pipe for the liquid in the autoclave.

186,823, October 1, 1918. Diphenylamine, A. E. Houlehan, Can. $C_6H_5NH_2$ is condensed to C_6H_5 NHC_6H_5 by the presence of an iodide as a catalyst. The presence of not more than 2% of water is advantageous and the NH_3 formed is removed at intervals to hasten reaction.

187,173, October 22, 1819. Purifying Camphor, J. E. Crane, Can. Impure camphor is heated in a closed chamber to 300 to 500° F. so as to modify the camphor oil to a product not readily soluble in organic solvents. The camphor is then removed from the modified oil.

186,824, October 1, 1918. Diphenylamiie, H. Rogers, Can. $C_6H_5NH_2$ is condensed to $C_6H_5NHC_6H_5$ by the presence of a bromide as a catalyst. The presence of not more than 2% of water is advantageous and the NH_3 formed is removed at intervals to hasten the reaction.

186,825, October 1, 1918. Diphanylamine, A. P. Tanberg, Can. $C_6H_5NH_2$ is condensed to C_6H_5 NHC_6H_5 while heated in the presence of water and a substance containing Cl.

187,106, October 22, 1918. Purifying Gas or Other Fluids, W. O. Felt, Can. The gas is compressed to approximately 300 pounds per square inch and mixed with glycerine while under compression. The temperature of the mixture is reduced to 60° F. while under compression thereby separating glycerine and contained impurities and the purified gas is then liberated.

INDUSTRIAL NEWS

Since the signing of the armistice, it is estimated that about one-quarter of the munition workers in Toronto have been laid off. Among the chemical manufacturers affected is British Acetones, Toronto, Ltd., who have already entirely closed down their departments of bacteriology and chemistry.

Among the list of firms in Toronto who are contemplating making additions to their plants, or who have already commenced the work, we note the following:—

Canadian Allis-Chalmers Co., Ltd., Lansdowne Ave., $70,000.

Liquid Air Co., Maria and Boler Streets, $18,000.

B. F. Johnson Soap Co., Carlaw Ave., $18,000.

National Iron Works, Cherry St., $25,000.

Harris Abattoir Co., cooler building, $75,000; refinery, $13,000.

Universal Tool Steel Co., Dufferin and Springhurst Ave., $36,000.

The U. S. Government has ordered work stopped on the new naval explosive plant at Wisconsin, and it has been announced that the projected $9,000,000 naval nitrate plant at Indian Head, Md., would not be built.

The Structural Steel Company's plant at Weston has been purchased by the Massey-Harris Company, who will remove their gasoline engine manufacturing department to the new factory. The plant taken over at Weston covers 100 acres.

At a general meeting of the council of the Canadian Manufacturers' Association, held recently in Montreal, it was decided to ask the Dominion Government to take active steps in reconstruction work, and to make a grant of not less than $1,000,000 a year for research work with a view to finding new outlets for Canadian trade. It was also decided to urge upon the Government the necessity to furnish adequate shipping facilities.

The oil-loading docks of the Standard Oil Company at Baltimore, Md., were destroyed by fire on Nov. 22nd, the total loss being estimated at $1,000,000.

The plant of the Cement Products Co. of Canada, on the Island of Orleans, Que., has been sold by auction to G. Lachance, Regd., of Quebec, who propose to continue operations.

All restrictions on the use of platinum and iridium for other than war purposes have been removed by the War Trade Board, Ottawa. It is expected also that within a very short time importers of many articles from the United States will be allowed to return to the former method of direct dealing.

The Palmolive Co. of Canada, Ltd., 64 Natalie St., Toronto, have given a contract for a reinforced concrete addition to their factory to B. H. Prack, Lumsden Building, Toronto. The addition is to be erected at a cost of $10,000.

"The Stirling zinc-copper-lead deposit at Stirling, Richmond Co., C.B., is being extensively drilled. Four drills are in operation, and the company claim to date about 700 ft. ore body as proven. The ore occurs in altered igneous rocks and is composed of zinc blende, chalcopyrite, pyrite and quartz. Assays made at the laboratory of the Mines Branch, Ottawa, show values varying from 4 to 30 per cent. zinc with as high as 7.5 per cent. lead and 3.5 per cent. copper; also traces of gold and silver. The ore is very complex."—(The Canadian Engineer).

With a view to inducing university students to specialize in engineering, the Toronto branch of the University's Engineering Alumni Association has undertaken to provide funds for eight scholarships in the Faculty of Applied Science in the University of Toronto. When the money is required it is to be solicited from interested firms and individuals.

In the death, on Nov. 5th, of Mr. T. Aird Murray, of Toronto, the engineering profession has lost one of its ablest members. Mr. Murray was the first advocate in Canada of the chlorination of water supplies, and it was he who persuaded the City of Toronto to adopt the process.

The first battery of the new Dominion Steel Corporation coke ovens is in operation. It is estimated that the plant will cost several million dollars, and that it will produce 1,200 tons of coke per day, and several million feet of gas for use in the steel plant.

The new mills of Dominion Linens, Limited, Guelph, Ont., are nearing completion, and it is expected they will be operating at capacity by the end of the year. 8,000 spindles are being installed for spinning flax, and of these part have already arrived and been set up in place..

Hon. Wm. Sloan, Minister of Mines for British Columbia, has announced that the Provincial Department of Mines, under the terms of the Mineral Survey and Development Act, will prospect the Snowstorm Group, comprising five highly mineralized claims in Highland Valley, Yale District, B.C. This step was decided upon after inspection of the property by expert mining engineers, who gave as their opinion that this Group is likely to prove a valuable asset to the Province.

Mr. A. G. Langley, Provincial Resident Mining Engineer, Revelstoke, B.C., has been appointed to represent the Provincial Government at the enquiry into the rates charged by the Consolidated Mining and Smelting Co., of Canada, for the treatment of custom ores at the Trail Smeltery.

The Consolidated Mining and Smelting Co., of Canada, has acquired the Voight Copper Property on Copper Mountain, near Princetown, B.C., covering some 6,000 acres.

Exporters of mica have been advised that the authority given to customs collectors under section 6 of Memo. 2178-B to license such exports, has been cancelled, except when the applications for the export of mica are approved by the War Trade Board, Ottawa.

Major Austin C. Taylor, Director of the Department of Aeronautical Supplies, Imperial Munitions Board, has announced that instructions have been received to terminate contracts for fir lumber for airplane purposes in British Columbia. Notices of the cancellation of contracts are being sent to all sawmills supplying airplane fir to the Board.

Between 1,000 and 1,100 munition workers have been laid off by the Dominion Steel Company, Hamilton, on account of the cessation of munition orders. It is, however, expected that a number of these employees will be taken on again as soon as new machinery can be installed. The Canadian Westinghouse Company and others have also laid off a number of their men.

Three Niagara Falls, N.Y., companies—the Niagara Falls Power Co., the Hydraulic Power Co., and the Cliff Electrical Distributing Co.—have amalgamated. The merged concerns will be operated under the name of the Niagara Falls Power Co., and will have complete control of the power situation on the United States side at Niagara Falls. The Niagara Falls Power Co. owns 99.8 per cent. of the capital stock and all of the outstanding debentures of the Canadian Niagara Power Co., which latter concern operates one of the three plants on the Canadian side of the river.

A magnesium sulphate curing plant has been completed at Clinton, B.C.; the first shipment of these salts was consigned to the Stewart-Calvert Co., Inc., Wash., U. S. The deposits at Clinton are reported to be very extensive.

Several oil companies have been formed recently in British Columbia for the development of the oil prospects located in the Burnaby district, near Vancouver, B.C., these seepages are attracting much attention.

A chrome ore deposit has been found in the Lillooet district showing 52 per cent chromium and a trace of platinum; other deposits of this ore are being worked in the Zulameen, Boundry Bay and Ashcroft districts.

The installation of a plant for the manufacture of "Nuco," a butter substitute, is being completed in Vancouver, B.C. This product is composed of peanut oil, cocoanut oil and sweet milk. The process of manufacture is under the supervision of N. Andresen, of Denmark.

A smokeless fuel made from saw-mill waste by a continuous

distillation process, an invention of W. Thomas, of Nanaimo, B.C., is to be manufactured by the National Patents, Ltd., Vancouver, and marketed at $6 per ton. A sample of this fuel upon analysis gave: moistuie 3.0%, volatile combustible matter 3.5%, fixed carbon 90%, ash 3.5%, B.T.U. 13.740. It has been estimated that lumber waste amounting to 15,000 cords are destroyed every 24 hours in the incinerators of the saw mills on the B.C. coast.

Valuable deposits of bog iron ore have been located at Mons, B.C., estimated to have 500,000 tons of available ores. The Fe content ranges from 50 to 58.9 per cent, and is sold for about $4.50 per ton. Much of this ore has been shipped to Irondale, Wash., U. S., and used as a flux for the magnetite ores found at Texada Island, B.C.

The Nicholls Chemical Co., Barnet, B.C., are obtaining shipments of pyrites from the Granby Milling Co., Granby, B.C., for the manufacture of sulphuric acid.

CHEMICAL SOCIETY NEWS

The Ottawa Branch of the Society of Chemical Industry has mailed to its members an attractive programme of meetings for the winter session. A feature of the programme is the innovation of showing motion pictures at some of the meetings. Arrangements have been completed whereby films portraying industrial processes of a chemical nature will be shown during the winter at special meetings. The Ottawa Branch was only established last year and already it seems to be on a firm basis. The Committee, under the chairmanship of Dr. F. T. Shutt, and assisted by their enthusiastic secretary, Mr. S. J. Cook, has been very active this year, and success for the year's programme is assured. The subjects of the various meetings are as follows:

December: Chairman's Address, "The Organization of Canadian Chemists," by Frank T. Shutt, M.A., D.Sc.

January: The Clay Products Industry in Canada, by Jos. Keele, B.A.Sc.

February: Paint Pigments, Their History and Development, by S. J. Cook, B.A.

March: "The Teaching of Chemistry from the Manufacturer's Viewpoint," By F. J. Hambly.

April: Annual Meeting of the Ottawa Branch.

DENTAL RESEARCH PROJECT

At a recent mass meeting of the students of the Royal Dental College of Surgeons, it was decided to raise a fund to be devoted to dental science and research. Every student responded, with the result that $1,500 was raised, and this has been invested in Victory Bonds.

In view of the importance of dentistry in the safeguarding of public health, this is a step in the right direction, and more recent developments have shown the necessity for dental research.

The money raised at the meeting will form the nucleus of a permanent endowment for dental research to be held in trust, the objective being $50,000. A committee was appointed by the Canadian Dental Association to appeal to the dental profession and others for contiibutions.

SPHAGNUM MOSS

In addition to the extensive industrial use of sphagnum moss from which peat is manufactured, the experiments made by the Army Medical Staff will result in a largely extended use of this moss as a substitute for cotton in the making of antiseptic dressings. Mrs. J. T. McGregor, President of the Women's University Club, of Toronto, states that there are now thirty or forty workers devoting themselves to the preparation of sphagnum moss, and that there is opportunity for one hundred or more workers at the present time. The moss dressing is lighter, cooler, and more absorbent than dressings made from cotton.

PERSONALS

Mr. Lloyd Harris, formerly Chairman of the Canadian War Mission at Washington, has been appointed Chairman of the Canadian Mission in London. Mr. Harris is a member of the Massey-Harris Company and, as head of the Canadian War Mission in Washington, has been instrumental in obtaining immense munition and other war orders for Canada. Mr. Frank A. Rolph, of the firm of Rolph, Clark, Stone & Co., Toronto, succeeds Mr. Harris as Chairman of the Canadian War Mission at Washington.

Mr. W. R. Worthington, B.A.Sc., chief engineer of the sewer section of the Toronto Department of Works, has been appointed as acting engineer to the Ontario Board of Health during the absence of Capt. F. A. Dallyn of the C.E.F. to Siberia.

Mr. E. Mavaut, formerly of the Public Works Department at Ottawa, has been appointed director of the sand and stone testing laboratories of The Milton Hersey Co., Ltd., Montreal.

Within the next couple of weeks the chemical departments of the School of Practical Science, Toronto, will be filling up with men released from war work. The first to come back is a second-year man—C. P. Lailey.

Miss Bessie Cooke and Miss Marion Grimshaw, graduates of McMaster University, who have been for some time doing war work as chemists with the British Chemical Company, Trenton, have now taken positions in the American Cyanamid Co. at Niagara Falls.

On Nov. 6th, the death of Lieut.-Col. Harrison, controller of the entire Department of Chemical Warfare, occurred in London, following an attack of pneumonia. He entered the army as a private in 1915, and immediately became connected with the Chemistry Research Bureau, in which capacity he developed all the protective apparatus against gas attacks. Latterly he had had complete charge of the whole organization of the Bureau.

R. L. Dorrance, B.A., has returned from the British Chemical Co., Trenton, Ont., to his former position on the laboratory staff of the Dominion Experimental Farms, Ottawa.

Miss Bessie Cooke and Miss Marion Grimshaw have left the works of the British Chemical Co., Trenton, and have gone to Niagara Falls to take up work with the American Cyanamid Company.

Miss Winnifrid Grindell has been transferred from the laboratory of the Consolidated Rubber Co., Montreal, to that of the Dominion Tire Co., Kitchener, Ont.

Dr. H. S. Davis, recently appointed to the staff of the Kopper's Co., has been placed in charge of the Research Division of that company's laboratory at the Mellon Institute.

RECENT APPOINTMENT AT McMASTER

Professoi W. O. Walkei, of Queen's University, Kingston, has been appointed Professor of Chemistry in McMaster University for the coming year, succeeding the late Professor J. Bishop Tingle, who died in August. Professor Walker is a giaduate of the University of Toronto, wheie he received his degree in 1902. After graduation he taught for two years in St. Andrew's College. Subsequently he spent two years in Chicago, teaching in Armour Institute of Technology, and doing research work at the University of Chicago. Professor Walker has been at Queen's for the past eleven years.

The Chemistry Department at McMaster was very strong under Professoi Tingle, his work in research being iecognized by the Dominion Advisory Council of Industrial Research with a grant to be expended this year. Many of Professor Tingle's graduates aie now holding iesponsible positions in other universities and in industrial plants. Professor Walker succeeds Professor Tingle with an experience which will enable him to carry on successfully the work of the department.

OBITUARIES

C. Arnold J. Galbraith, B.S.A.

On November 11th at St. Boniface Hospital, Winnipeg, the death occurred of Professor Arnold J. Galbraith, B.S.A., Professor of Chemistry at Manitoba Agricultural College, Winnipeg. Professor Galbraith succumbed to an attack of influenza after a short illness. He was born at Hornby, Halton County, Ont., and at time of death was only 33 years of age. He was educated at Streetsville and Ontario Agricultural College. He took post-graduate work at the University of Toronto, returning to Guelph as lecturer. In 1915 he went to Winnipeg, and since that time had been very active in soil survey work in Manitoba. He became a force in everything he took up and the College of Agriculture has suffered a very great loss indeed. He was an active member of the Manitoba Chemical Society and his death makes the first break in the ranks of this young chemical organization.

Allain Joseph Landry, B.A., B.Sc.

The many friends of Mr. A. J. Landry, B.A., S.Bc., will be grieved to know that he has succumbed to an attack of pneumonia following influenza.

Mr. Landry was born in Dorchester, N.B., twenty-seven years ago and was educated in the schools of his home town. After this preparatory training he entered the University of New Brunswick and graduated with the degree of B.A. He then went to France, and for a year studied chemistry in the University of Paris. Returning to Canada he entered the Faculty of Applied Science of McGill University from which he graduated with the degree of B.Sc. in Chemical Engineering. Shortly after leaving McGill, he joined the staff of the Foods and Drugs Laboratory of the Inland Revenue Department at Ottawa and in a few months qualified as a public analyst. On the establishment of the Sub-Laboratory in Halifax, he was appointed as Assistant to the Analyst in Charge, and carried out the duties of this official position most creditably until the time of his death.

Mr. Landry made friends quickly and kept them permanently. He was one of those whom to know was to like, and his memory will live long in the hearts of those who knew him. He was a man of fine culture and broad views, with many a word of encouragement to those about him. He was in every sense an optimist, and the world loses one of its best types in his passing. As a good chemist, a conscientious worker, a cultured Christian gentleman, we mourn his loss.

Henry E. Randall, Jr.

The death of Henry E. Randall, Jr., from influenza at Montreal, on Monday, Octobr 21st, was a great and sudden loss to the industries with which he was connected. Mr. Randall was born at Island Pond, Vermont, March 28, 1893. He was a graduate of the Massachusetts Institute of Technology and a member of the Engineering Institute of Canada. He was power sales engineer for the Shawinigan Water and Power Co. until last October, when he became General Manager of the Ludlum Electric Furnace Corporation. He was greatly interested in the development of electro-chemistry in Canada, and a very active member of the American Electro Chemical Society, His energy and ability was far beyond the average and his untimely death will be very deeply regretted by all his business friends and associates.

RECENT INCORPORATIONS

Belleville.—The Belleville Rubber Company. Wilson Saunder Morden, Toronto, manager. Capital $1,000,000. Rubber.

Leaside.—Leaside Munitions Co., Ltd. Emil Andrew Wallberg, C.E., Toronto. Capital $10,000,000. Chemical engineers, metallurgists, ores, metals, minerals, oil and stone.

Guelph.—Flax Spinners, Ltd. David Melville Sanson, manufacturer. Capital $500,000. Flax, vitriol, dyestuffs.

Toronto.—Twin City Coal Mines. Wm. Robt. Smythe, solicitor. Capital $500,000. Coal, oil, metal and mineral substances, natural gas, chemicals.

Sudbury.—LaForest & Clemow, Ltd. Louis LaForest and Thos. Clemow. Capital $250,000. Timber, ores, minerals and metallic substances.

Toronto.—Matachewan Gold Mines, Ltd. Walter J. Boland, solicitor. Capital $4,000,000. Ores, metals, minerals.

Toronto.—The New Extension Mines, Ltd. Arthur L. Reid, solicitor. Capital $150,000. Ores, metals, minerals.

Chatham.—Ontario Peat Products, Ltd. John Garner Kerr, solicitor. Capital $40,000. Peat and peat products.

Toronto.—Standard Oil Producing Co., Ltd. Wm. Andrew McMaster, oil merchant. Capital $300,000. Ores, metals, minerals, oil and gas.

Sault Ste. Marie.—The Algoma Pyrites Co., Ltd.—John A. McPhail, solicitor. Capital $1,500,000. Ores, metals, minerals, acids and chemicals.

Haileybury.—United Iron Works and Machine Co., Ltd. Geo. G. T. Ware, solicitor. Capital $500,000. Ores, metals, minerals, coal and oil, foundry and machine building.

Toronto.—Alloy Steel Works, Ltd. Reginald H. Parmenter, solicitor. Capital $1,500,000. Engineers, chemicals, fertilizers, dyes, oils, cement, ores, metals and minerals.

BOOK REVIEWS

Dyeing with Coal Tar Dyestuffs. By C. M. Whittaker, B.Sc. (London: Ballière, Tindall & Cox. Price 7s. 6d. net), 1918, pp. 214.

It has long been a drawback of our technical education that the college graduate, on commencing his industrial career, is positively handicapped by his academic knowledge because of his lack of information on current industrial conditions. This book aims, and succeeds well, in presenting the reality of a living industry. The volume should serve as a guide to the standard literature of the subject and prove of value to the consultant, in obtaining a comprehensive view of the whole industry.

The aim of the publishers is, in their own words, "That it will supply mental munitions for the coming industrial war." Many authors of note have collaborated in the preparation of the work, assuring the reader that he is receiving absolutely first-hand information. The book was evidently written with a view to giving the reader a firm grasp of the chemical principles involved, so that under actual commercial conditions he will know the why and the wherefore of the methods employed.

The text is divided into some 14 sections, the titles of which should indicate the scope of the matter treated:

(1) A General Survey of Dyeing. A most instructive summary leading up to the present trends and future outlook.

(2) The Varied Uses of Basic Dyestuffs. The processes with all fibres are described.

(3) The application of Acid Dyestuffs.

(4) The Turkey-red Industry, and other uses of the Alizarine Dyestuffs.

(5) The application of the Direct Cotton Dyestuffs, including those which develop on the fibre.

(6) The Azo-coloring Matters and their special use in Dyeing.

(7) Resorcine Dyestuffs.

(8) The Application of Sulphur Dyestuffs.

(9) The application of Vat Dyestuffs.

(10) The Dyeing of Union Materials and Garments.

(11) Colors produced on the fibre by the oxidation of Coal Tar Products.

(12) Other uses of Coal Tar Products.

(13) Dyestuffs other than Coal Tar Dyestuffs still in use.

(14) The Valuation and Detection of Dyestuffs.

The book shows every indication of excellent planning and should find a place close to the hand of every practical dyer.

Chemical, Drug, and Metal Markets

The Quotations below represent average prices for the quantities indicated. Larger quantities may be obtained at lower figures.

TORONTO, 30th Nov., 1918.

The signing of the armistice, which ends the great war has not brought any general fear regarding the maintenance of industries. In many lines of chemicals and metal products prices have so far been maintained where dislocation was expected, the continuance of a large degree of government control having a steadying effect, through frequent official conferences with the industries affected. The stoppage of the production of poison gases for the armies has affected the market for chlorine, arsenic, picric acid, etc., and those engaged in these and war chemicals are studying hard on the problem of turning over to peace industries. Bleaching materials, caustic soda, glycerine and some acids are already lower and prices will be more or less unsettled till peace requirements are better defined. Saccharine is one of the articles that have taken the most violent fall. Before the war this was sold at $1 a pound. During the war it reached the unheard of level of $40 a pound and now has dropped to $11.

It is expected that the Governments of Canada and the United States as well as Great Britain, remembering that their action brought into being many chemical and metallurgical industries into which private capitalists could not have ventured alone, will give the men who have been trained in this work a chance to "consolidate" the ground gained in peace work.

In the import trade heretofore nomopolized by Germany a good opportunity now comes to Great Britain, France and Switzerland. Such firms as the Geigy Co. of Switzerland and the St. Denis Works of Paris are already having goods released from the Canadian market, and representatives of some British firms are on the way to Canada to gather up the several ends of the interrupted trade. Mr. T. D. Wardlaw, Canadian agent of the Geigy Co., reports that 50,000 lbs. of Swiss dyestuffs are on the way out to the U. S. and Canada. It is proposed to create a commission to regulate dyestuff imports in the U. S.

The metal market is being steadied by the large orders for railways and public works and other peace trade, and dealers report no falling off in business. The destruction of the steel plant of the British Forgings of Toronto and the closing of the works of the Steel Co. of Canada at Brantford, owing to cancellation of American Government orders are noteworthy events of the past month. There is considerable machinery on shells and other war work which will have to be changed or scrapped at an early date. Pig iron has dropped about 25 cents in New York in the past month.

An interesting event of the month is the starting of 40 coke ovens at the plant of the Steel Company at East Hamilton.

The pulp and paper mills of Canada are rapidly increasing their foreign trade, and the figures of the last six months indicate a total export of over $80,000,000 for the year.

Enemy, that is, German, financial interests in 18 chemical companies in the U. S. will be sold by auction between now and Feb. 5th next, following seizures by the Alien Property Custodian.

Acetanilid, C.P.	Lb.	1.10—1.20
Acetic acid, commercial, crude, 28% in bbls.	Lb.	10⅜—11¼
" " 80 per cent. pure	Lb.	—.29
Acetone	Lb.	.40
Aspirin	Lb.	3.50
Alcohol, grain, bbl.	Gal.	8.50
Alcohol, methylated, bbl.	Gal.	1.65
Alcohol, wood, 95 per cent., refined bbl.	Gal.	1.60
Alum, ammonia lump	100 Lbs.	8 50
Aluminum Sulphate, high grade, bags	100 Lbs.	4 00
Ammonia, Aqua 26°	Lb.	.13—.15
Ammonium Carbonate	Lb.	(Nominal)
Benzoic Acid	Lb.	4.50
Bleaching Powder, 35% drums	Lb.	3½—5
Borax, crystals	Lb.	.07—.08
" powdered	Lb.	.08—.09
Boric Acid, powdered	Lb.	.16—.16½
Calcium Chloride, fused, in drums	Lb.	.02—.025
Carbolic Acid, white crystals	Lb.	.60—.65
Caustic Soda, ground, Bbl.	Lb.	6½—7½
China Clay, imported	per ton	$20—$25
Citric Acid, domestic, crystals	Lb.	1.10—1.25
Cobalt Oxide, black		1.50—1.75
Copper Sulphate (Blue Vitriol)		.11½—.12
Fuller's Earth, powdered	100 Lbs.	2.00 2.50
Glycerine, drum	Lb.	.70
Hydrochloric Acid, carboys, 18°	Lb.	.02—.03½
Lead Acetate, white crystals		Nominal)
Lead Nitrate	Lb.	.18—.20
Magnesium Carbonate, Magnesium Sulphate, B.P., bbl.	Lb.	.22—.25
Nitric Acid, 36° carboys	100 Lbs.	.10
Oxalic Acid	Lb.	.42—.45
Potassium Bromide	Lb.	1.60—1.70
Potassium Nitrate, Kegs		(Nominal)
Potassium Permanganate, bulk	Lb.	2.50—2.75
Phenacetin	Lb.	4.00—4.50
Salicylic Acid	Lb.	1.50—1.60
Soda Ash, bags	Lb.	.03½—.04
Sodium Acetate	Lb.	.20—.25
Sodium Benzoate	Lb.	4.25
Sodium Bicarbonate, 100% pure	100 Lbs.	4.00—4.50
Sodium Bichromate, bbls.	Lb.	.28—.30
Sodium Cyanide, bulk, 98-99 per cent., in cases	Lb.	.33—.35
Sodium Hyposulphite, kegs	100 Lbs.	4.00—4.50
Sodium Nitrate, refined	100 Lbs.	5.50—6.00
Sodium Silicate, according to density	100 Lbs.	3.00—3.50
Sulphur, ground	100 Lbs.	3.00
Sulphur, roll	100 Lbs.	4.50—5.00
Sulphuric Acid, 66° Be, carboys	100 Lbs.	3.25—3.50
Tannic Acid, commercial	Lb.	.90—1.10
Tartaric Acid, crystals or powdered	Lb.	95—1.00
Tin Chloride, crystals	Lb.	.75—.80
Zinc Sulphate, com.	Lb.	.6½—.07

Metals

Aluminum, No. 1, 98-99%	Lb.	.45—.50
" Government price in 50 ton lots for ingot 90-99% A 1	Per ton	$6.60
Antimony	Lb.	.12—.15
Brass, yellow ingots	Lb.	.21—.22
" red	Lb.	.25—.26
Cobalt, metal	Lb.	2.50—3.50
Chrome, 50% high grade	Per unit	$1.70
Cobalt oxide, grey	Lb.	1.65
Copper, casting	Lb.	.30
Copper, electrolytic	Lb.	.30
" Am. Government price (electrolytic and casting	Lb.	.26
Iron, bars	100 Lbs.	5.25
Lead	Lb.	.10¼—.10½
Magnesium	Lb.	1.75—2.25
Mercury	Lb.	2.00—2.50
Nickel, shot or ingot	Lb.	.40—.45
Platinum, pure Goverment price	Oz.	105.00
Silver, bar (U. S. Govt. price)	Per troy oz.	1.01—
Spelter	Lb.	.10—.10½
Steel, mild	100 Lbs.	5.50
" nickel, in bars, 3½% Nickel	Lb.	.25—.27
" Sheet, Bessemer, 28 gauge	100 Lbs.	8.15—8.50
Tin	Lb.	.80—.90
Zinc	Lb.	10½—11½

INDEX TO CANADIAN CHEMICAL JOURNAL.—VOL. II.

Contributed Articles

General Subject Index

GOVERNMENT CONTROL OF FLAX

By Order-in-Council under date of October 23rd, 1918, all surplus fibre flax seed in Canada over and above such quantities as will be required for seeding purposes for 1919, is placed under the control of the Dominion Government. All fibre flax of the 1918 crop is to be threshed, graded and made ready for shipment by December 31st. The price fixed by the Government is $27.25 per sack of 182 pounds net recleaned fibre seed, in carload lots of 400 sacks. This action is the result of the war situation and the shortage of the flax crop in Ireland. The surplus supply in Canada is to be sent to Great Britain and Ireland for fibre production purposes.

Index to Advertisements

EMPLOYMENT DEPARTMENT

The charge for condensed advertisements of "Engagements Wanted," or "Positions Open," is 50 cents per month for advertisements of 40 words or less, no charge being made for the use of box numbers in care of CANADIAN CHEMICAL JOURNAL.

ENGAGEMENTS WANTED

Chemist, with extensive experience in the texile trade, well up in coloring and the testing of dyes, wools, yarns, and all other products used in a woollen or cotton mill. Box 24, Canadian Chemical Journal.

Young practical manufacturing and analytical chemist desires change of position. University graduate. Laboratory and factory experience in organic and inorganic chemicals. Experienced in starting up new processes. Toronto or vicinity preferred.—Box 31, CANADIAN CHEMICAL JOURNAL.

Metallurgical Engineer, University graduate, 29 years of age, with a thorough metallurgical and chemical training, and a varied practical experience in laboratory and plant. Executive abilities. Seeks position in industrial chemical or metallurgical laboratory or plant where ability and ambition are a necessary qualification.—Box 29, CANADIAN CHEMICAL JOURNAL.

Chemist, familiar with gun-cotton, powder, T.N.T., nitric and sulphuric acids. Experienced in analysis of acids. Capable manager. Address, Box 887, Trenton, Ont.

POSITIONS OPEN

Chemist and Bacteriologist Wanted. Practical organic chemist with bacteriological experience, for chemical and bacteriological work on liquid and powdered milk. References as to experience required. Salary to be agreed upon. Apply, Canadian Milk Products, Limited, 10-12 St. Patrick St., Toronto, Canada.

Process Foreman in TNT Explosives or Acid manufacture who desires to connect with a related industry which manufactures a commercial product can communicate with Box 17, CANADIAN CHEMICAL JOURNAL.

Large chemical works requires the services of several chemical Foremen who offer experience in some branch of process work. Must be accustomed to handling men. Good prospects in a permanent industry. State salary wanted and particulars on work you have engaged in. Box 18, CANADIAN CHEMICAL JOURNAL.

WANTED—Electrometallurgist and Metallographist required for a Canadian research laboratory. The work will cover extensive investigations on alloys. Good opportunity for the right man. There is also an opening for a graduate in metallurgy to investigate general metallurgical problems. All applications giving education, experience, and salary desired, should be addressed to Box 27, Canadian Chemical Journal, Toronto, Ont.

Chemist wanted for steel plant laboratory, experienced in analysis of steel plant materials and products. In replying, state age, training, experience and salary desired. Apply to Chief Chemist, Algoma Steel Corporation, Ltd., Sault Ste. Marie, Ont.

Wanted—A student in chemistry or chemical engineering, in every university and college in Canada, to represent a technical journal. Man in upper year preferred, with some canvassing experience. For full information address Box 32, CANADIAN CHEMICAL JOURNAL.

Chemist, capable of handling small industrial laboratory, one with electrical experience preferred. State age, experience and salary expected in first communication. Box 28, CANADIAN CHEMICAL JOURNAL.

CLASSIFIED INDEX OF ADVERTISEMENTS

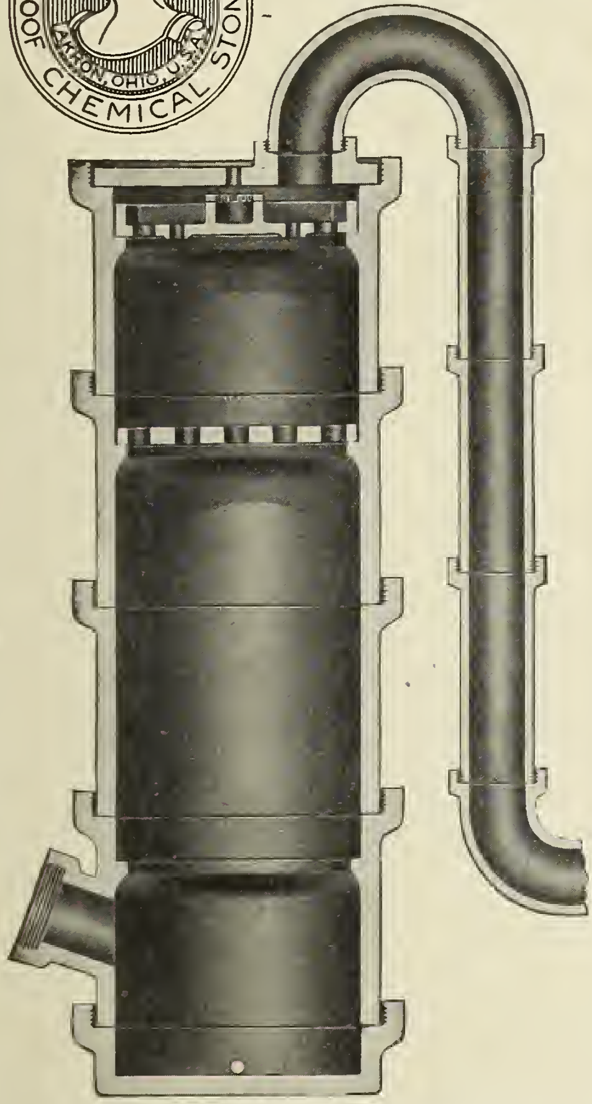
CLASSIFIED INDEX OF ADVERTISEMENTS—*Continued*

MAURICE A. KNIGHT ACID PROOF CHEMICAL STONEWARE AKRON, OHIO, U.S.A.

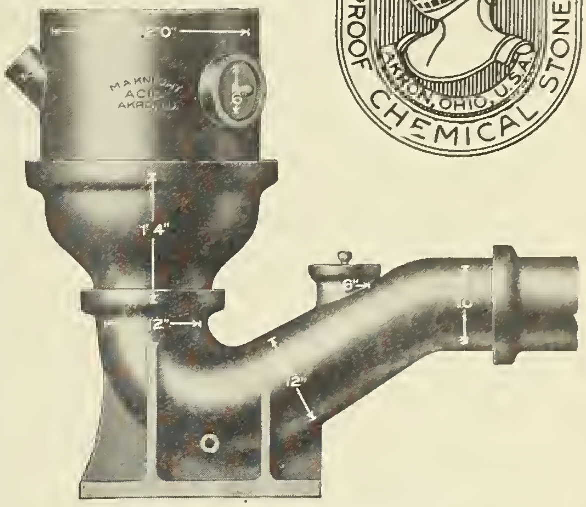
Chemical Stoneware

Our ware will withstand the action of Acids, Alkalies and Chemicals. Hot or Cold, Strong or Weak.

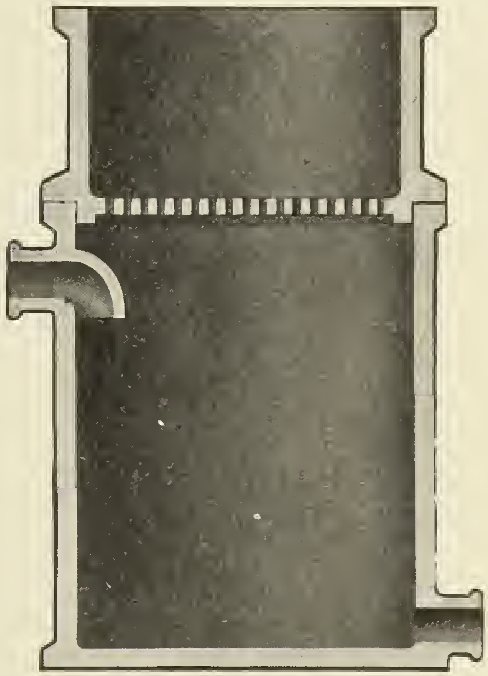
MAURICE A. KNIGHT ACID PROOF CHEMICAL STONEWARE AKRON, OHIO, U.S.A.



CONDENSING OR ABSORBING TOWER
Made in all sizes and designs, with all kinds of packing and fittings, from 12″ to 42″ bore. Showing cascade or saucer bottom ring sections for perforated support plates and top cover gas outlet.



STANDARD IMMERSION BASES
Showing trap base, basin and collar.



ACID SUCTION FILTER "B"
Made in any capacity up to 150 gallons. With cover and faucets.

ACID-PROOF CELLARIUS TOURILL
Made in three standard sizes. The most efficient cooling and absorbing apparatus offered.

We make every description of Acid-Proof Stoneware Apparatus, Standard or Special.

We carry a large stock of Acid-Proof Brick and other tower packing.

MAURICE A. KNIGHT Office: Kelley Avenue **East Akron, Ohio**